How to cope with wood movement P. 72

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SEPTEMBER 1996 ISSUE #90

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SEPTEMBER 1996 • Vol. 13, No. 6 • Issue No. 90

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Better Homes and Gardens® *WOOD*® magazine (ISSN-0743-894X) is published nine times a year in January, February, April, June, August, September, October, November, and December by Meredith Corporation, 1716 Locust St., Des Moines, IA 50309-3023. Periodicals postage paid at Des Moines, Iowa, and additional mailing offices. Better Homes and Gardens trademark registered in Canada and Australia. Marca Registrada en México. **ONE-YEAR SUBSCRIPTION PRICES:** U.S. and its possessions $25; Canada, $36; other countries, $45. Canadian GST Reg. #BN 12348 2887 RT. **POSTMASTER:** Send address changes to Better Homes and Gardens *WOOD* Magazine, P.O. Box 55050, Boulder, CO 80322-5050.

CUSTOMER SERVICE INFORMATION: For service on your magazine subscription including change of address, phone toll-free **800/374-9663.** Or, write to Better Homes and Gardens *WOOD* Magazine, P.O. Box 55050, Boulder, CO 80322-5050. Please enclose your address label from a recent issue.
EDITORIAL INFORMATION: Address letters and questions to THE EDITOR, *WOOD* Magazine, 1912 Grand Avenue, Des Moines, IA 50309-3379.

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Now appearing on WOOD ONLINE:

Check out the Woodworker's Software Library, a collection of woodworking shareware programs you can download to run on your computer. In the library you'll find a foot-inch-fraction calculator, a program for generating cutting diagrams, another that figures tilt and miter settings for compound miters, and one that lays out templates for cutting dovetail joints.

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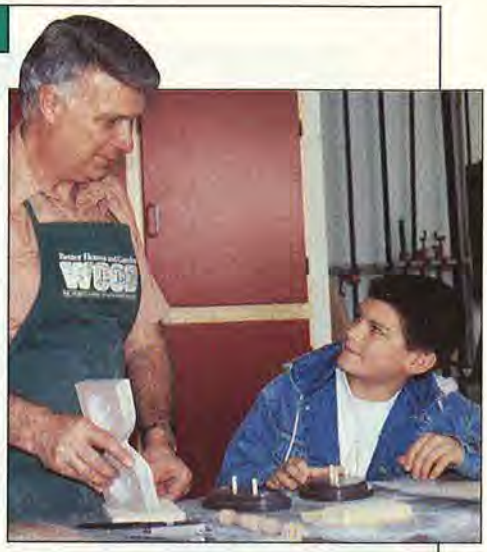
THE EDITOR'S ANGLE

Andy Rowland

Boy Woodworking Wonder



Here's Andy Rowland taking in some woodworking wisdom from Chuck Hedlund in the *WOOD* magazine shop.

A few months ago, I received an intriguing letter from 10-year-old Andy Rowland. It said, in part, "I read your magazine, and I really enjoy it. I've been getting it for two years now." Then, he went on to say that he has a scrollsaw, a jigsaw, a belt sander, and lots of other tools. He even has a pretty big shop of his own in his basement. I guess the reason I'm so impressed with Andy is that at his age I was still trying to learn how to pound a nail in straight!

To make a long story short, after receiving Andy's letter, I invited him and his parents, Dean and Margie, for a tour of our shop. In addition to having a really great time with this young woodworker, I learned quite a bit about him, too. For example, I found out that Andy got his woodworking start with the help of a friend who let him pound together some projects from his scrap pile.

In the two years Andy has been a woodworker, he's built a magazine rack, some medium-sized deer, a tissue box cover, and some little apples. And he's already discovered one of the joys of this hobby—giving his handiwork to family and friends so they can enjoy it, too.

I, for one, will be interested to follow this young woodworker's progress in the years ahead. By the way, if you come in contact with a young would-be woodworker, remember that it doesn't take much encouragement to light that woodworking fire.

WOOD ONLINE™— Have you checked it out yet?

In the August issue, you may have read the article introducing our entry onto the World Wide Web. If you did, I hope you have taken a gander at the goodies we already have put on it for you.

As with everyone else on the Web, we're really just at the beginning stage of tapping into this exciting new information source. But as time goes by, being hooked up to a computer probablly will be commonplace. So, in anticipation of that day, we're going to continue to put more and more information on the Web for you.

You say, "That's great, but I don't have a computer?" Here's a suggestion. Call one of your friends who's connected to the Web, and ask if you can come over and use his computer. Then, type **http://woodmagazine.com**. Our home page will come up on the screen, and you can click on the heading that looks interesting. Who knows; this may be just the springboard you've needed to launch yourself into the wonderful world of computers.

Larry Clayton

Print this article

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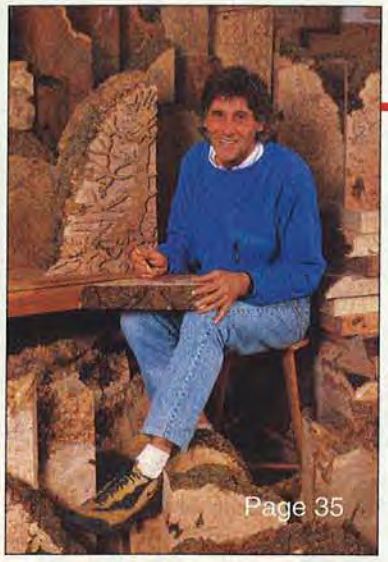
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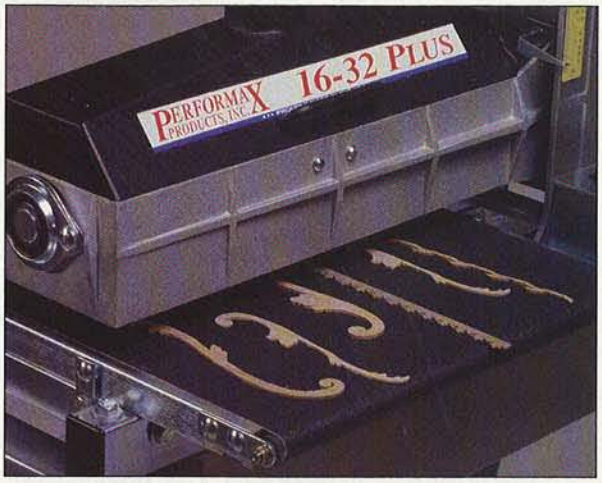
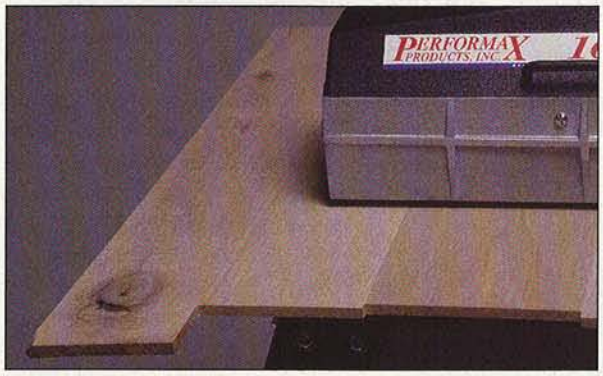
This issue's cover wood grain: Aspen





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TALKING BACK

We welcome comments, criticisms, suggestions, and even compliments. Send your correspondence to: Talking Back, *Better Homes and Gardens® WOOD®* Magazine, 1912 Grand Ave., Des Moines, IA 50309-3379. To contact us via computer, use these on-line addresses: CompuServe: 74404,3516 Internet : 74404.3516@compuserve.com

Improvements on the miter jig

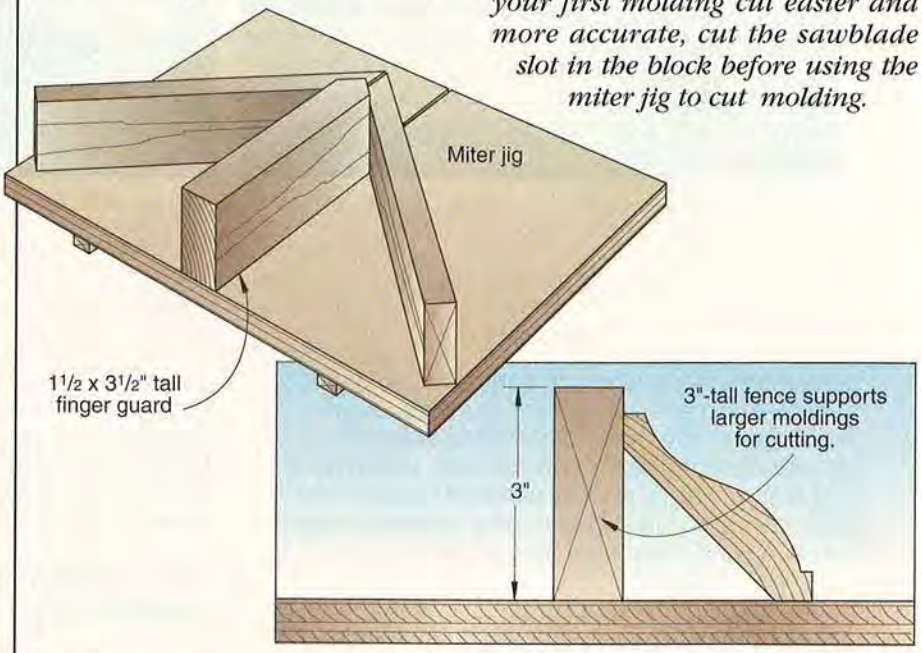
I made a miter-cutting jig similar to the one described in the December 1995 article "10 Quick and Easy Scrapwood Jigs." I've used several miter jigs over my 40-plus years as a woodworker, and I have a couple of suggestions on how to improve this design.

First, I made the fences on my jig higher than those in the article. My 3"-high fences help me cut larger moldings (see drawing *bottom*). I determined the 3" fence height by measuring the maximum cutting height of my tablesaw, and subtracting ⅛".

Second, I improved the safety of the jig by placing a piece of wood directly behind the kerf opening in the fence (see drawing *below*). This finger-guard block totally encloses the sawblade after it passes through the fence. I determined the height of this block by adding ½" to the maximum blade height of my tablesaw.

—Tim Hanson, Indianapolis

We have one more suggestion for readers who plan on adding this block to their miter jig. To make your first molding cut easier and more accurate, cut the sawblade slot in the block before using the miter jig to cut molding.



A source of small brad-point drill bits

The October 1995 issue included an article on making a salt-and-pepper set. The directions call for using a 3⁄32" brad-point bit to bore the holes. However, the smallest brad-point drill bit I can find in my catalogs is ⅛". Where can I purchase the 3⁄32" brad-point drill bit?

—Allen Walker, Bloomington, Ind.

Allen, the 3⁄32" brad-point drill bit we used is part of a set of drills made by Insty-Bits. You can find these in many woodworking catalogs or stores, or you can contact the manufacturer directly at: Insty-Bits, 2310 Chestnut Ave. W., Minneapolis, MN 55405. Call 612/381-1060.

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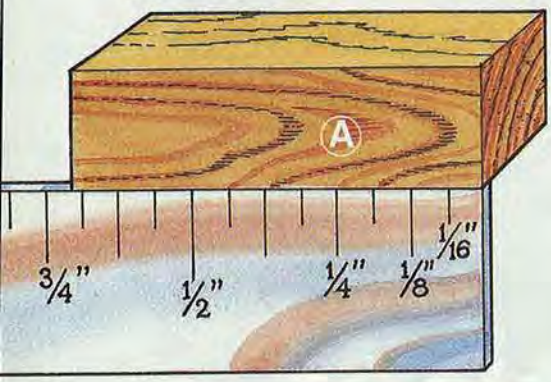
CALIPERS

The tools you need when close isn't good enough

What woodworkers need to know

Accurately gauging mortise depth ranks high on the list of workshop challenges. But this and other measuring difficulties disappear when you grab a precision caliper.



A ruler with 1/100" graduations gives accurate measurements but isn't particularly easy to read.

Measuring between the marks

A measurement becomes little more than a close estimate when it falls between divisions on a ruler. For example, piece A in the drawing *above top* is longer than 11/16", but shorter than 3/4". It's hard to say *exactly* how long it is.

For greater accuracy you could measure against a more finely divided ruler. But packing more divisions into an inch also makes a ruler harder to read. (See the photo *below left.*) Instead, rely on precision calipers like the ones shown in *Photos A and B* for fine measurements. With one, you can measure easily to a thousandth of an inch (1/1000" or .001").

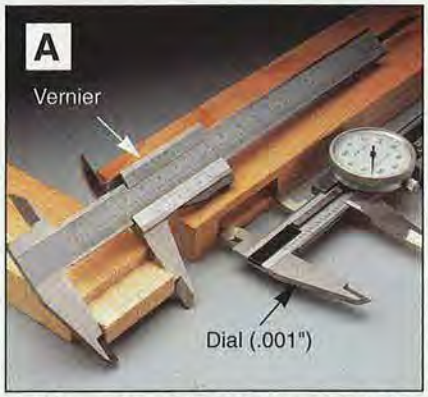
- **Vernier caliper.** Pierre Vernier, a French mathematician in the 17th century, devised the vernier scale. A vernier scale slides along a main scale and indicates precise subdivisions of the main scale's smallest increments.
- **Dial caliper.** With this one, as you might imagine, a dial indicator provides a direct reading of the subdivision. This means you can read the dial caliper more quickly and easily than a vernier caliper, making it our choice for general workshop use.
- **Digital caliper.** This instrument shows the exact measurement on a calculator-style, digital readout. Though expensive, it is the easiest to read among the calipers.

Do I need thousandths?

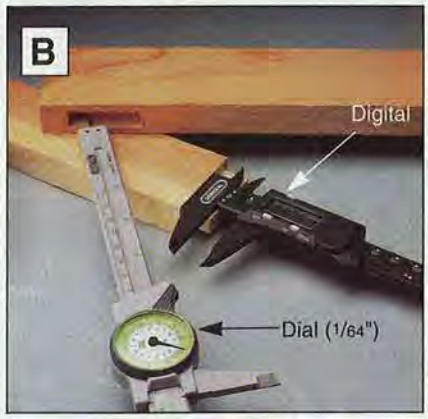
Given that wood shrinks and swells, most woodworkers regard 1/16" as an acceptable tolerance. So why would you need a device capable of measuring to .001"?

Part of the answer lies simply in the desire to fit projects together without gaps or misalignment. (Ever tried to put a 1/4" dowel through two 1/4" holes misaligned by that 1/16" tolerance?) The more accurately you measure, the argument goes, the more likely everything will fall into place.

Then, too, consider the effect of cumulative errors. If you edge-glue two pieces of stock, each ripped to a tolerance of 1/16", the total width could be off by as much as 1/8" either way. To achieve a 1/16" tolerance, each piece would need to be accurate to 1/32", or about 31 thousandths of an inch (.031").



Calipers take both outside and inside measurements with ease.



A rod for taking depth measurements is a handy feature. Some calipers will take step measurements between the end of the bar and the end of the sliding jaw.

Multipurpose measurers

Vernier, dial, and digital calipers offer more than precision. They're also versatile, allowing you to take measurements you couldn't get with an ordinary ruler.

Continued on page 10

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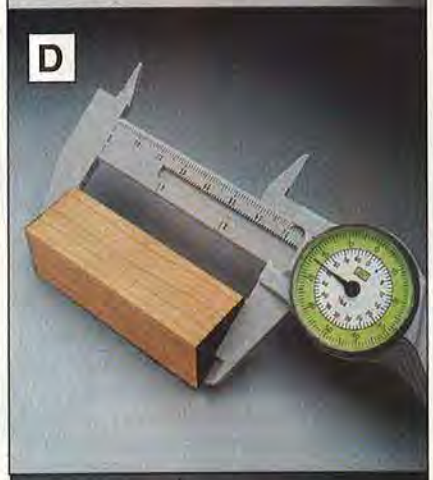
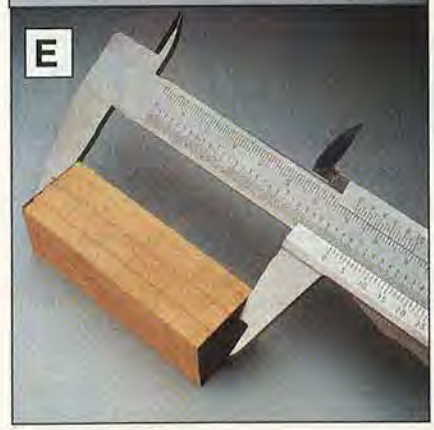
CALIPERS

Continued from page 8

All will take outside measurements (shown at left in *Photo A, previous page*) as well as inside (right in the photo) and depth (left in *Photo B, previous page*) measurements. Many calipers can take step measurements, as shown right in *Photo B*. This feature comes in handy for gauging rabbets, tenon lengths, dado depths, and such.





Reading the results

Digital caliper. This is the only one of the three that delivers a direct measurement. Start by zeroing the caliper, following the manufacturer's instructions. Then, take the measurement. The digital display reports the dimension, shown in *Photo C*.

Dial and vernier calipers, on the other hand, call for a little math on your part when it comes to reading them. Here's how to do it.

Dial caliper. First, close the jaws, and zero the dial. (Rotate the dial bezel until the pointer indicates 0. Often a knob screws in to lock the zero adjustment.)

Take your measurement. Then, read the scale on the caliper bar. In *Photo D*, the caliper is open wider than 2", but not quite 3". So, the reading is 2". For dial calipers calibrated in 64ths of an inch (a good choice for woodworking), add the fraction indicated by the dial gauge (49/64") to the measurement shown on the bar (2"). The result: 2 49/64".

A dial calibrated in .001" increments divides each .1" into 100 parts. Add the dial reading (.068" for our test piece) to the bar reading (2.7") to find the measurement, 2.768".

Vernier caliper. This caliper's movable jaw carries a vernier scale. For woodworking, we're partial to calipers marked with 1/16" increments on the bar and 1/128" divisions on the vernier scale. Decimal-calibrated calipers, more commonly found, feature .025" increments on the bar (illustration, *bottom of page*) and 25 divisions of .001" each on the vernier.

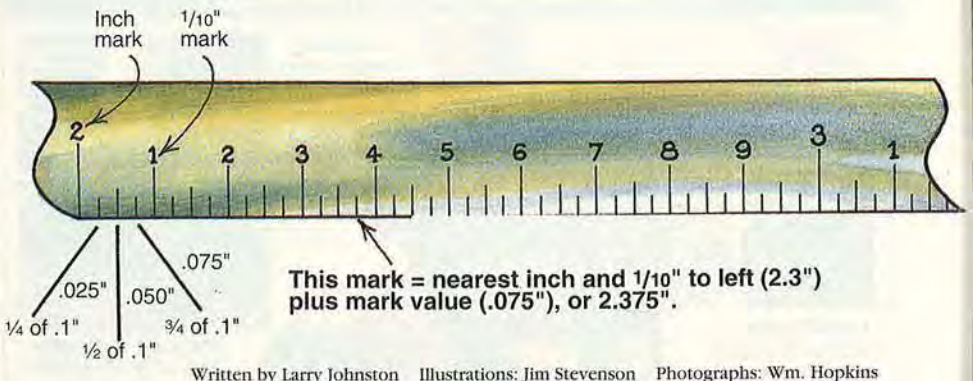
The index mark for reading the main scale is the 0 on the vernier scale. If it doesn't align exactly with one of the divisions on the bar, look at the other vernier marks. You'll find one that lines up directly with a mark on the bar. (Which mark it lines up with is immaterial—0 is still the index.)

In *Photo E*, line 18 matches with a bar mark. So 18 is the measurement in thousandths of an inch to add to the reading on the bar just left of the index mark. The measurement: 2.750" on the bar plus .018" on the vernier, or 2.768".

With 1/128" vernier graduations, find the fraction that lines up with a bar mark. Then, add that amount to the bar reading. (For our example, it would be 2¾" on the bar plus 7/128"—or 1/64"—on the vernier scale for a total of 2 49/64").

Buying Guide

Precision calipers. Catalog numbers and prices (not including postage and handling) for the calipers in the photographs are: digital, 123925, $74.95; dial with .001" scale, 01R62, $29.95; dial with 1/64" and .01" scale, 17V42, $29.95; and vernier with decimal inch scale, 14N12, $32.50. Woodcraft Supply, P.O. Box 1686, Parkersburg, WV 26102-1686. Call 800/225-1153 to order.



Written by Larry Johnston Illustrations: Jim Stevenson Photographs: Wm. Hopkins

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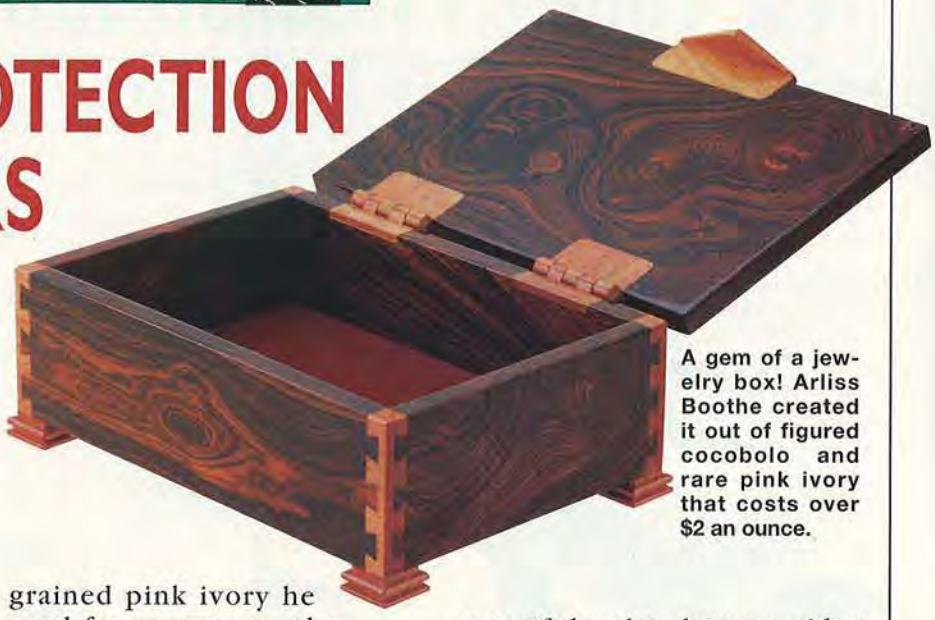
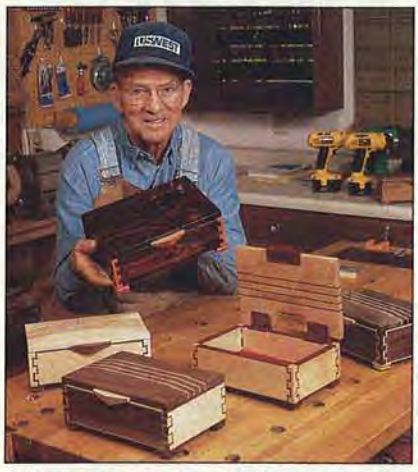


A gem of a jewelry box! Arliss Boothe created it out of figured cocobolo and rare pink ivory that costs over $2 an ounce.

So, you want to get a high-gloss finish, but the wood in your project has a somewhat open grain—like walnut, teak, or mahogany. You can do it, if you follow what works on Arliss Boothe's jewelry boxes, such as the finely crafted example shown *above right*.

Arliss, 70, a retired Iowa state highway patrolman who lives in Indianola, Iowa, was lucky enough to find a uniquely figured piece of cocobolo as the basis for his box. But, because of its open grain, it would be difficult to achieve the mirrorlike finish he planned. Yet, nothing less than a supersmooth high gloss could complement the dense, tight-grained pink ivory he used for accents on the legs, corners, handle, and hinges.



Arliss' jewelry boxes have wooden hinges, dovetails, and other accents in contrasting woods, plus super-shiny lacquer finishes.

Bring on the lacquer

Prior to joining the Highway Patrol, Arliss had run an auto-body business, and the skills he developed in spray-painting have not gone to waste in his woodworking. "I know finishing, especially lacquer," says Arliss. "I worked with it so much in the auto-body business that I realized I had to get the grain of the wood filled with lacquer in order to have a glasslike finish."

For his spraying, Arliss chooses gloss Deft Clear Wood Finish (a lacquer-based product) because it not only has more body than semigloss, but also produces a clearer finish. "Semigloss seems to have more of a yellowish tint," he says. And Arliss uses the lacquer at what he calls "can consistency" (unthinned) because it builds much quicker.

Build up the coats

"I don't seal the wood or fill the grain with anything before I spray on the lacquer," explains Arliss of his multi-coat approach. "I think filler deadens the natural look of the wood."

After finish-sanding his assembled jewelry box with 150-grit sandpaper, Arliss lays down four coats of the gloss lacquer with a spray gun. Then, he carefully sands down the gloss and what he calls "orange peel" with 400-grit wet-or-dry sandpaper dipped in water.

"The water acts as a lubricant and doesn't penetrate the lacquer," he says as he sands the dried lacquer, as shown in the photo *below*. Arliss occasionally checks the surface against a light to see if he missed any shiny spots. "You have to be careful not to sand through the finish, especially at corners and along the edges."

Wet-sanding with 400-grit wet-or-dry paper removes what Arliss calls "orange peel" from the first four coats of sprayed-on lacquer.

Continued on page 14

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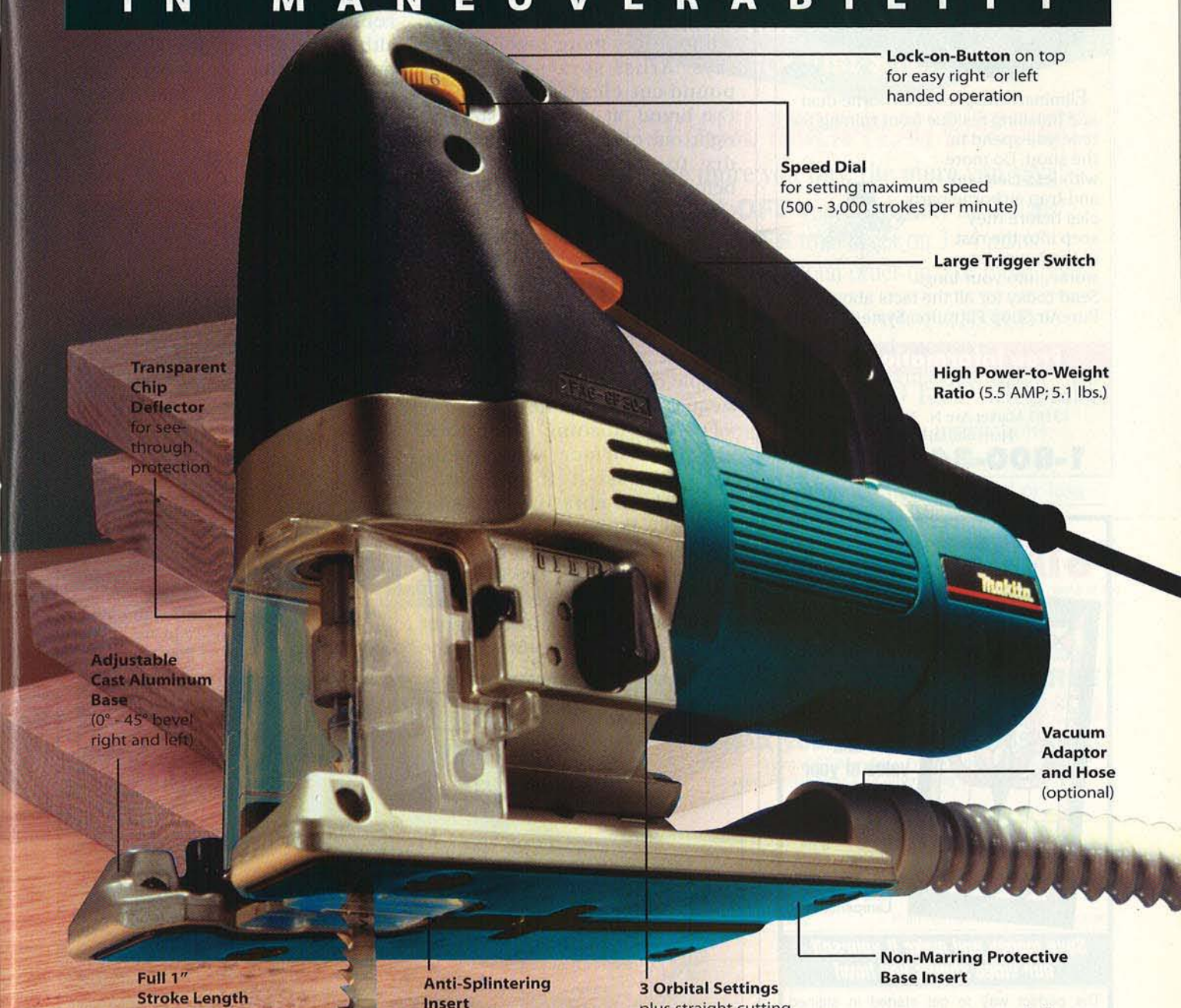

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Continued from page 12

Seal with shellac, then lacquer again and buff

Following the wet-sanding, Arliss seals the lacquer with shellac. "If I didn't, and just added more lacquer, it would continue to develop more orange peel and I wouldn't get as smooth a surface without lots more sanding," he says. Arliss sprays on three-pound-cut clear shellac [Bulls Eye brand, at hardware stores], right out of the can, then lets it dry for two to three hours before going over it lightly with 600-grit sandpaper.

Arliss next sprays on four more coats of unthinned gloss lacquer, as shown *below*. Then comes patience. "Although I'm anxious to get the project finished, I put the box away somewhere for a couple of weeks to really let the lacquer cure," he notes.

For the finishing touch to a glasslike surface, Arliss uses 3M's Finesse-it II Finishing Material, an abrasive- and silicone-free liquid polishing compound, applied with a random-orbit sander. With the sander's buffing pad, he polishes the cured lacquer, as shown *right*. "In the auto-body business, they rely on the compound to polish out clearcoat," he says. "But it works equally as well on the sprayed lacquer."

A lot of work for a finish? "Maybe," replies Arliss, "but it's one that will last and that you can renew just by buffing. And although I end up applying nine coats, counting the shellac, with the sanding before sealing I'm probably removing 70 percent of the first four."

Photographs: John M. Schultz

Buffing polishing compound with a random-orbit sander brings out the gloss on the multi-coat lacquer finish.

After applying a sealer coat of shellac to the jewelry box, the craftsman sprays on four more coats of gloss lacquer. In total, the box receives nine coats of finish.

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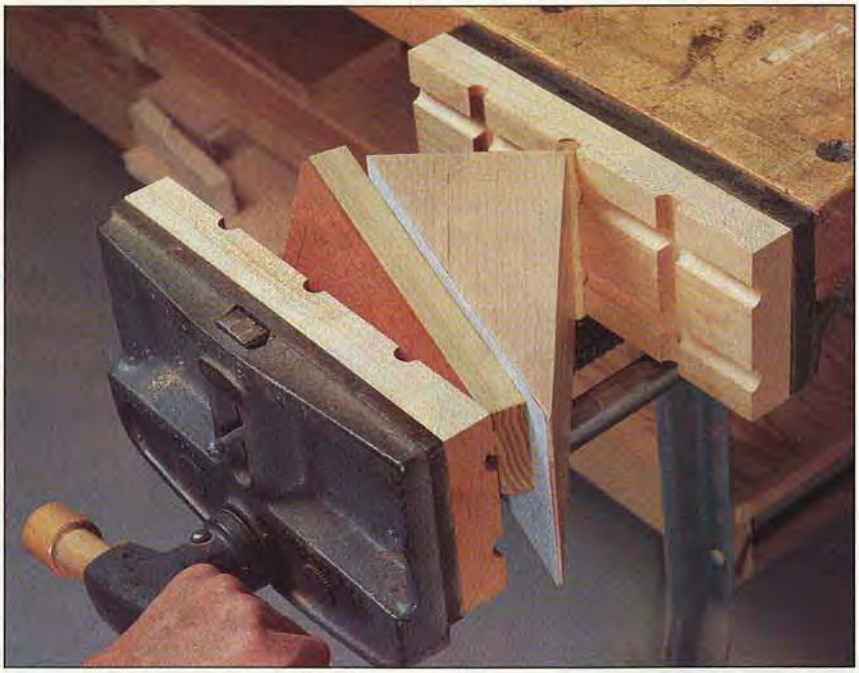
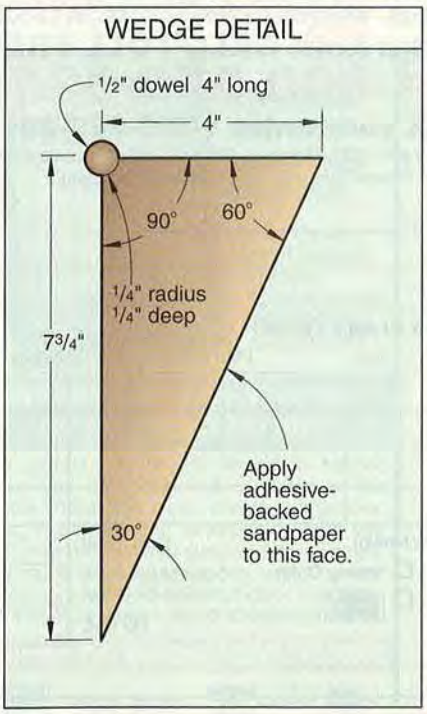
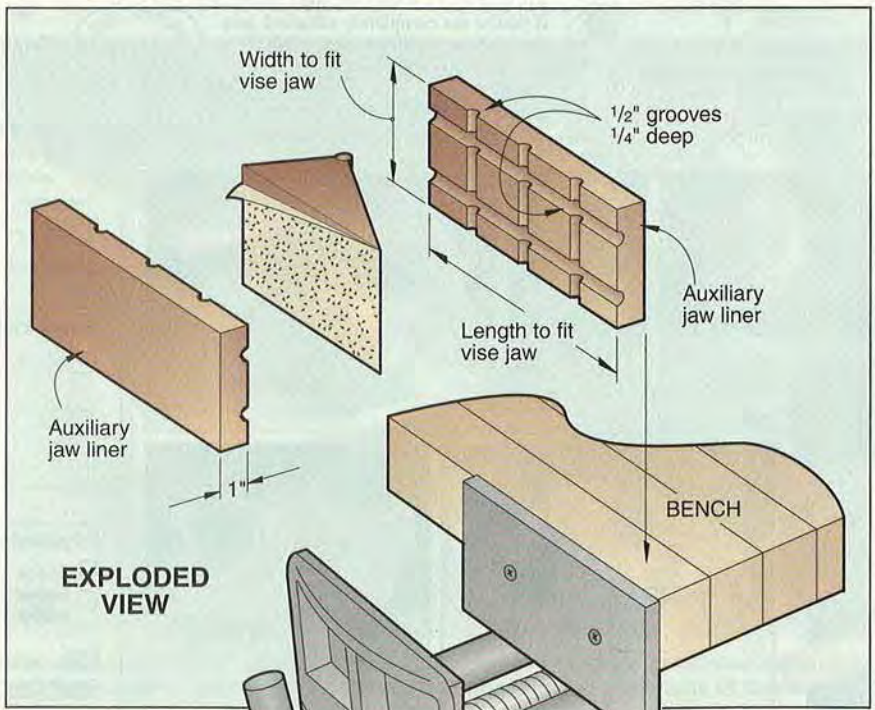


To make the auxiliary jaw liners, cut two pieces of 1"-thick hardwood equal in length and width to your vise jaws. Then, put a ¼"-radius round-nose bit into your table-mounted router. Rout three equally spaced grooves across the width of the jaw liners and two grooves along the length of the jaws. Center the lengthwise grooves 1" from the top and bottom of the jaw liners. Now, secure the liners to the jaws.

Construct the wedge by cutting several pieces of stock using the guidelines in the Wedge Detail drawing *below* for size. Glue up sufficient stock to make the depth of the wedge equal to the width of the jaw liners. Rout the groove in the 90° corner of the wedge as shown, and fasten the dowel with glue and brads. Finally, give the wedge some gripping power by adding a piece of adhesive-backed 100-grit sandpaper to its longest face.

Project Design: Chuck Hedlund
Illustrations: Roxanne LeMoine
Photograph: King Au





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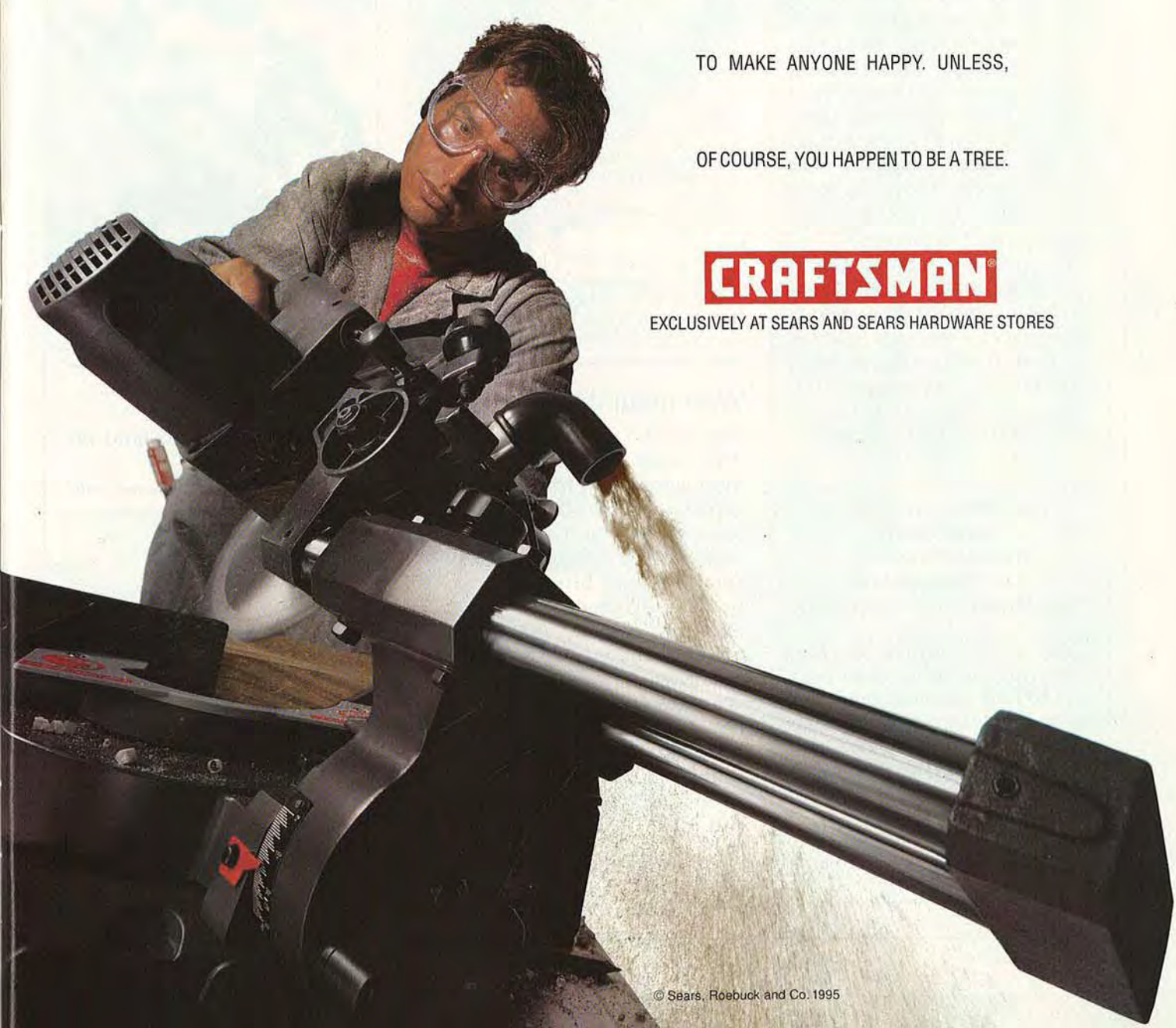

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Is it time to call for help? No way! Just check out our shop tip *right*.

Until evolution bestows upon woodworkers a third hand to help hold awkward assemblies, we'll have to use our brains to figure out solutions. Bob Wingard's shop tip *right* should help many of you hold on to your dust-collector bag while tightening the band clamp around it. The *WOOD*® magazine staff thought Bob's tip was so helpful that we awarded him the prize for the best shop tip.

If you've ever come up with one of these "third hand" solutions—or any other problem-solving idea—we want to know about it. If we publish it, we'll pay you $40, and you may even win a tool prize. To be considered, send a letter with a photo or drawing of the idea to:

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We try to publish original shop tips, so please send your idea to only one magazine. Also note that we cannot return your submissions. Thanks, and keep those shop tips coming.

Kerry Gibson

GENERAL-INTEREST EDITOR

Hook-and-loop strip ends dust-bag frustration

If you have trouble holding the lower dust-collection bag while tightening the band clamp that secures it, try this. Buy a 1"-wide piece of hook-and-loop material at a sewing-supply store that's as long as the circumference of your dust-collector bag. Epoxy one of the strips to the perimeter of the dust collector where shown, and sew the mating strip to the inside of the bag.

Now, when you reinstall the bag, the hook-and-loop strips hold it securely in place while you tighten the band clamp. To keep the adhesion secure, vacuum the dust off the hook-and-loop strips from time to time.

—Bob Wingard, Cleveland, Tenn.

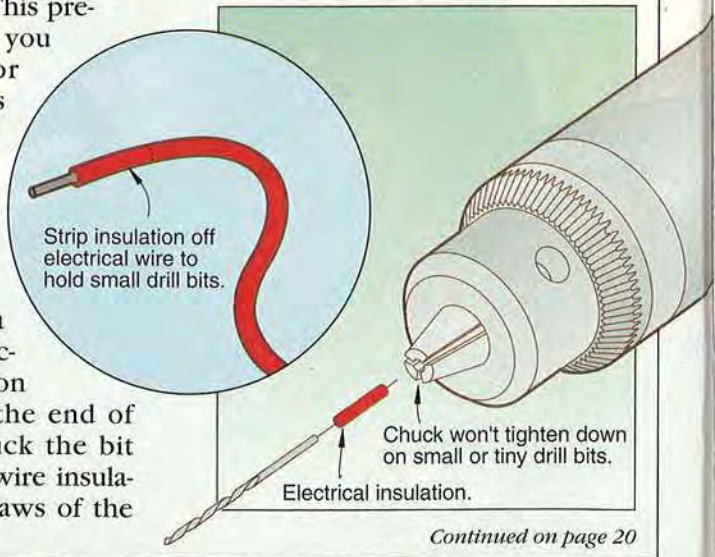
For sending in the best shop tip in this issue, Bob receives a shopful of these Quick-Grip clamps worth $250.

Wire insulation helps hold tiny drill bits

The jaws on the chucks of many drills don't close completely—most leave a tiny, triangle-shaped gap in the center. This presents a problem if you want to use 1/16" or smaller drill bits because the chuck may not get a grip on such a slender shaft.

To prevent these tiny bits from slipping, strip off a short section of electrical-wire insulation and push it onto the end of the bit. Then, chuck the bit into the drill. The wire insulation will give the jaws of the chuck enough grip to hold the minuscule bit firmly.

—Judy Coffey, Elk Grove, Calif.



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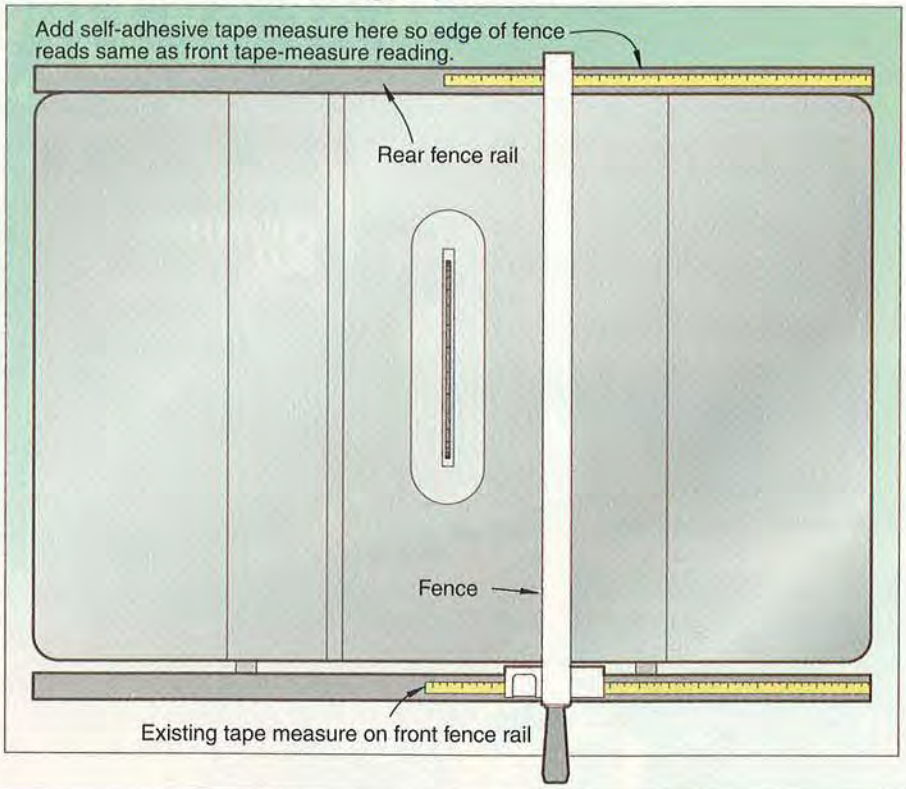
Continued from page 18

End fence alignment hassle with rear measuring tape

Having trouble getting your fence to line up parallel with the blade or miter-gauge slot on your tablesaw? For those of you who have a fence with a square or flat rear rail, here's a quick and easy solution to this problem.

First, buy a suitable length of an adhesive-backed tape measure. Secure the tape measure to the rear fence rail so that it reads the exact same measurement at the right-hand miter slot as the measurement scale on the front of the fence. Then, set your blade parallel to the miter slot by following the instructions in your tablesaw owner's manual. Whenever you position the fence, just make sure that the face of the fence bar aligns with the same measurements on the front and back rails before locking.

—Scott Geurin, San Clemente, Calif.



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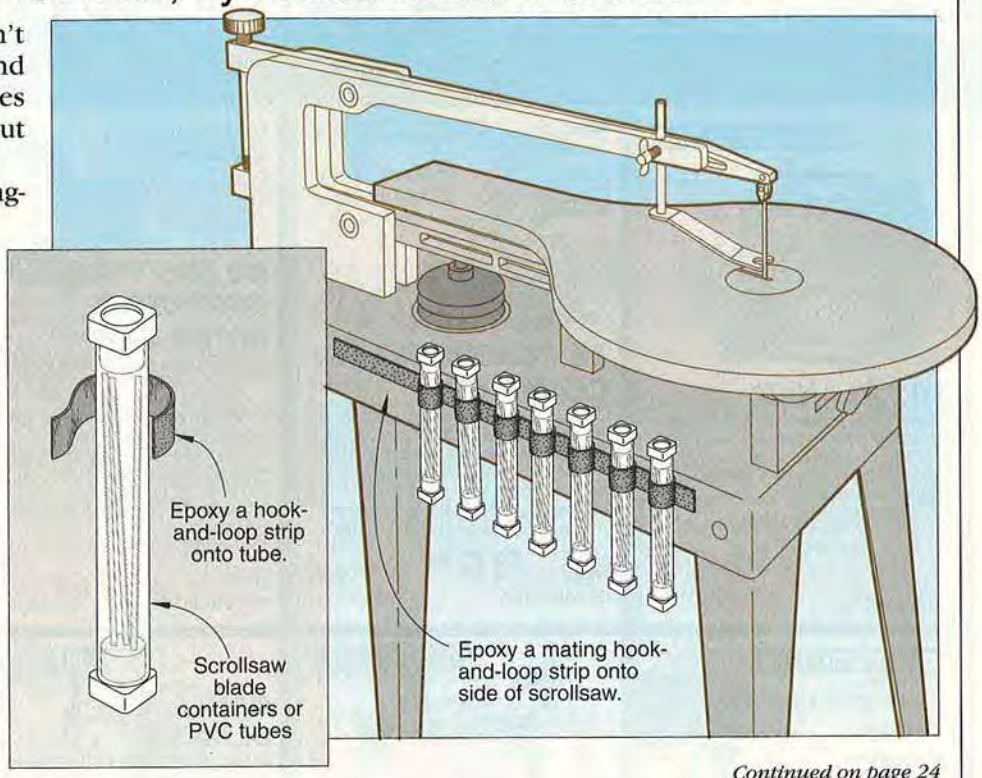
—Vyron D. Kuver, Des Moines, Wash.



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Index pin contains 36 - 10° spacings for accurate fluting and marking on workpieces. 4" face plate, center assembly tail stock, sput assembly head stock and 6" and 12" tool rests. (Stand sold separately). Distance between centers: 37"; Swing over bed: 12"; Spindle speeds: 575, 980, 1560, 2520 and 3580 RPM; Motor: 1/2 HP, 1725 RPM, 115V, 60 Hz AC, swing mounted to headstock; Drive spindle: No. 1 Morse taper plus 3/4-16 threaded; Tailstock: No. 1 Morse taper; 2-3/8" ram travel; Ship. wt.: 80 lbs.

ITEM 06841-0SFA **$139.99**

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Multiple clutch plates permit instant adjustment. Simply depress plates to slide handle against workpiece. Includes heat-treated steel bars with cast iron jaws, plated steel screws, and hardwood handles.

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12"	05975-4SFA	$4.95
18"	31264-3SFA	$5.95
24"	05976-5SFA	$6.95
30"	34389-1SFA	$7.45
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LIMIT 1

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COMBINATION 6" BELT AND 9" DISC SANDER

1 HP, 110V, 8 amps, 3450 RPM, all ball bearing motor; overall height: 40"; table tilt 0° to 50°; table surface: 6-1/2" x 12-3/4"; two position work table for disc or belt use; disc speed: 1720 RPM; belt: 6" W x 48" L; belt speed: 1280 FPM; weight: 121 lbs.

ITEM 06852-0SFA **$199.99**

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SAVE 25%

HEAVY DUTY 16 GAUGE BRAD TACKER

This unit packs extra punch to cleanly drive extra long brads every time. Use for cabinetry and carpentry jobs, also paneling, casings, and other construction applications. Features solid aluminum magazine with sliding cover.

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20 PC. SET

- 20 sizes from 1/4" to 3/4" by 16ths, 7/8", 15/16", 1" to 2" by 8ths

ITEM 31130-7SFA **$34.99**

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ITEM 32404-8SFA **$29.99**

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- Accepts .745" chisel shanks
- 1/2 HP, 110V, 2.3 amps • 3-1/2" swing
- 59 lbs. ship. wt.

ITEM 30036-5SFA **$179.99**

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2 PC. 3/4" HEAVY DUTY PIPE CLAMP SET

Constructed from heat-treated cast iron, these durable clamps keep your work rock steady. Just screw the handle side onto a 3/4" threaded pipe and slide the spring loaded end on. You're ready to go! Pipe not included.

- Handle screw operating range: 2-1/8"
- 1-1/2" throat depth
- Weight: 2-7/16 lbs.

ITEM 31255-5SFA **$2.93**

15 PC. TUNGSTEN CARBIDE TIPPED ROUTER BIT SET

With long life tungsten carbide tips and the most used routing shapes, this is the set all serious woodworkers need. Ground to ultra close tolerances for the best finish available. Includes individually organized storage case.

- 1/4" shanks

Includes: 1-1/4" rabbeting♦, 1-3/8" cove♦, 1-1/16" roman ogee♦, 1-1/4" rounding over♦, 1/2" flush trimming♦, 1-3/16" 45° chamfer♦, 1/2" dovetail, 3/4" straight,1/2" straight, 3/8" V-groove, 1/4" combination panel, 1/4" straight, 1/2" mortising, 1/4" self-piloting flush trim, 3/16" self-piloting 7° bevel trim

♦Includes pilot bearing

~~$69.99~~

ITEM 31164-2SFA **$49.99**

CENTRAL MACHINERY

GREAT FOR ODD SIZED SHAPES

SLASHED 24%

1" x 30" BELT SANDER

Solve your sanding problems with this handy belt sander. Remove the belt back plate and sand all types of curves and odd shapes. With the back plate in place, you can apply pressure for faster stock removal.

- Motor: 1/4 HP, 2 amp, 60 Hz, 120V, 3450 RPM • Table: 5" x 5"
- Shipping weight: 19 lbs.

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Just place stock and pull cam handles to positively lock material in place. Allows cutting tails, pins, half blind, and standard dovetails. Accepts stock up to 12" wide and 1-1/4" thick.

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16" SCROLL SAW

- Precision milled 14-1/2" x 8" table tilts 0° to 45° • 5-1/2" blade length
- Use either plain or pin end blades, 5-1/2" long • 1/8 HP, 110V, .83 amps
- Heavy duty cast iron frame and base reduce vibration
- 1750 SPM blade speed
- 7/8" blade stroke

ITEM 34618-0SFA **$59.99**

5 PC. 5-1/2" SAW BLADES

- Plain end type

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- Maximum depth of cut: 3/8"

ITEM 30289-5SFA **$199.99**

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- Air consumption: 3.5 CFM at 75 PSI
- Uses 18 and 19 gauge brads
- 1/4" NPT inlet

ITEM 32870-4SFA **$49.99**

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- Saw and table wood not included

Maximum miter & bevel: 45°; Rip capacity: 15-3/4"; Crosscut: 12-3/4"; Length: 24"; Height: 22"; Weight: 23 lbs.

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- Maximum planing capacity: 3/32"
- Shipping weight: 66 lbs.BLADES
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12-1/2" ROLLER AND BRACKET SET

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TIPS FROM YOUR SHOP (AND OURS)

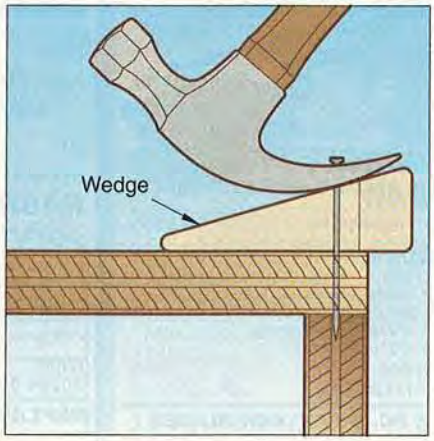
Continued from page 21

Here's an easier way to pull nails

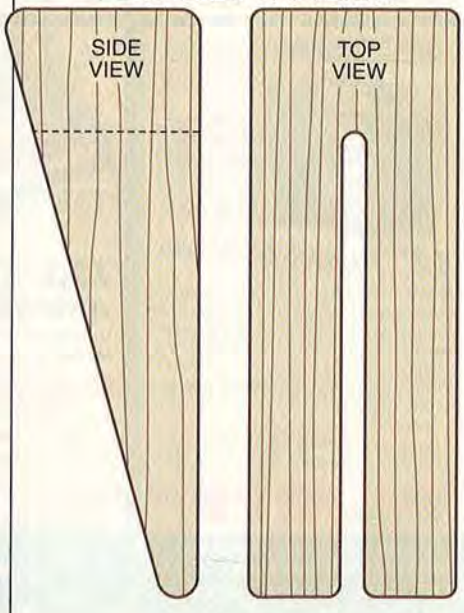
Everybody knows that a wedge increases the force you exert when pulling out a stubborn nail. But most of us wait until we're in a jam and then grab the nearest block of scrapwood to elevate the hammer.

If you want to pull nails the right way—with effortless efficiency—cut one of these nail-pulling wedges out of a sturdy piece of hardwood, and bandsaw the nail slot through the middle as shown. When you use it, just slide the slot around the offending nail, secure the head of the nail in the claws of the hammer, and pull back.

—Karl Rasmussen, Winnipeg, Man.



FULL-SIZED PATTERNS

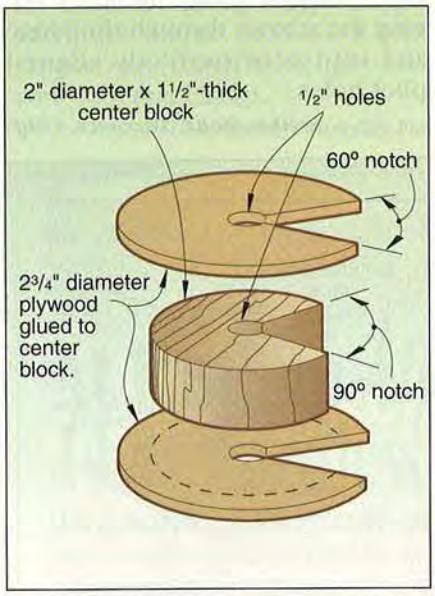


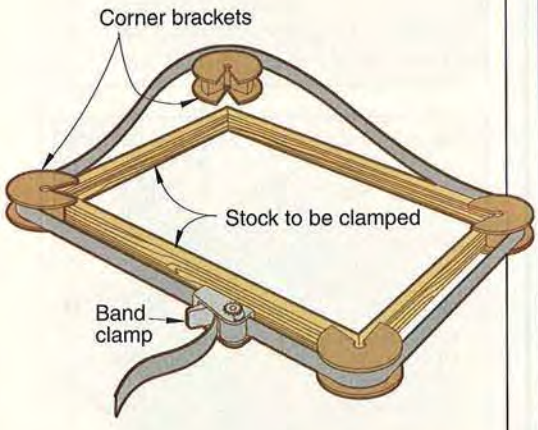
These corner brackets won't hurt wood

Some band clamps come with four metal corner brackets that can dent your project if you apply too much clamping pressure. For a kinder, gentler corner bracket, try building your own as shown in the drawings *below*.

Cut the center portion of the brackets out of softwood 2× material with a 2¼" hole saw. Make the top and bottom pieces from ⅛" hardboard or ¼" plywood. You also can customize these blocks by cutting the notches at different angles for projects with more than four sides.

—From the WOOD® magazine shop





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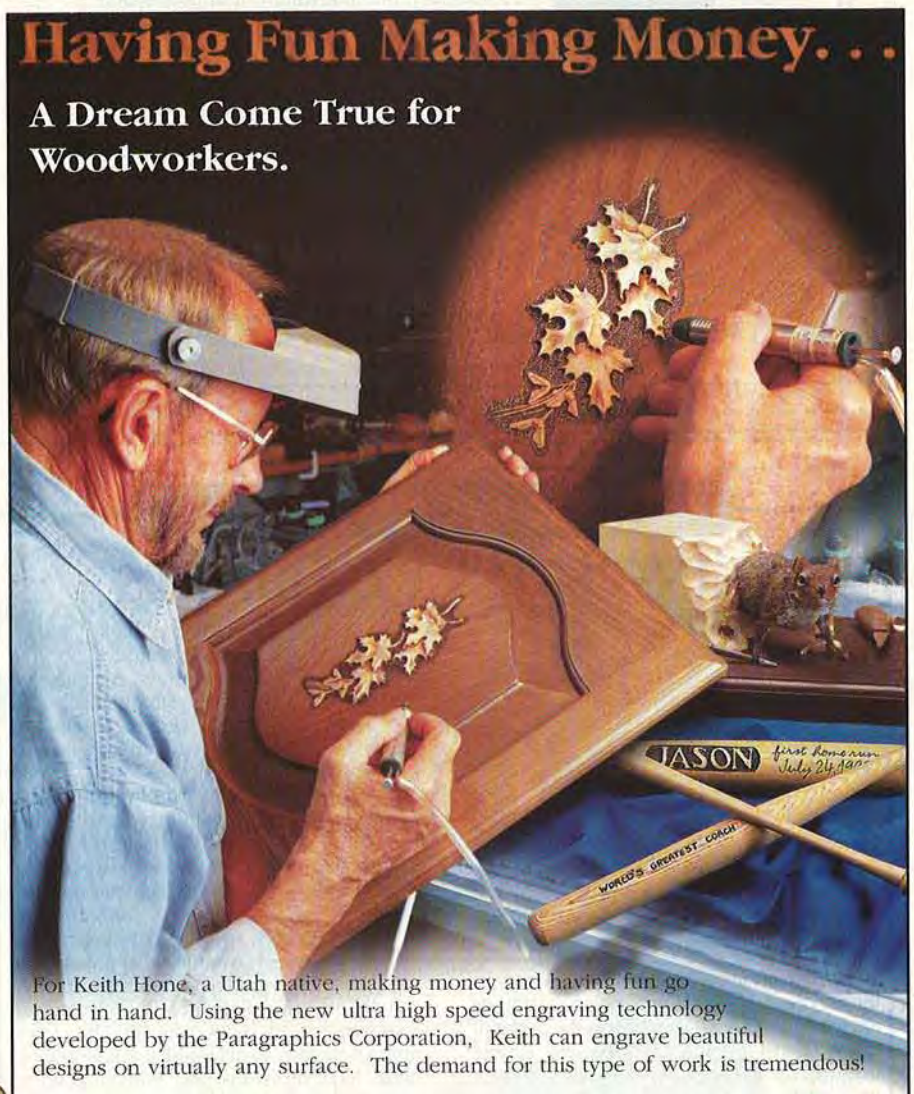

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FIXING STICKY CABINETS

Q: The finish of my kitchen cabinets has become sticky. Dirt is accumulating around the door pulls. I have tried everything to clean it off. Nothing seems to work. Is there anything I can apply to the surface that will remedy the situation? Please help.

Gary Nokelby, Chapel Hill, NC.

A: Unfortunately, we are not aware of anything that you can simply apply to your cabinets to reverse the stickiness. No doubt, your kitchen cabinets are finished with lacquer which is the choice of many cabinet manufacturers because lacquer dries quickly and can easily be recoated to touch up scratches or blemishes. Lacquer, however, does not hold up well in a kitchen environment. Compounds contained in cooking vapors tend to collect on the cabinets and soften the lacquer creating a "sticky" surface that accumulates dirt. The problem is compounded when strong household spray cleaners are used as they will further soften the lacquer.

Regrettably, softened lacquer must be removed from the cabinets using a scraper or chemical stripper. After the cabinet surfaces are stripped, sanded (and restained if necessary), we recommend applying three coats of a high grade polyurethane such as Wood•Kote **Ultra•Poly•Kote™**. Polyurethane takes longer to dry and is more difficult to touch up but it creates a durable finish that is resistant to harsh food substances and will hold up to repeated washing.

Hint: The lacquer finish on kitchen cabinets can be maintained for years if the surface is kept clean using mild soap or detergent.

Have a staining or finishing question? Ask Wood•Kote! Please write to Dept. Q. P.O. Box 17192 Portland, OR 97217 or Fax to (503) 285-8374

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TIPS FROM YOUR SHOP (AND OURS)

Continued from page 24

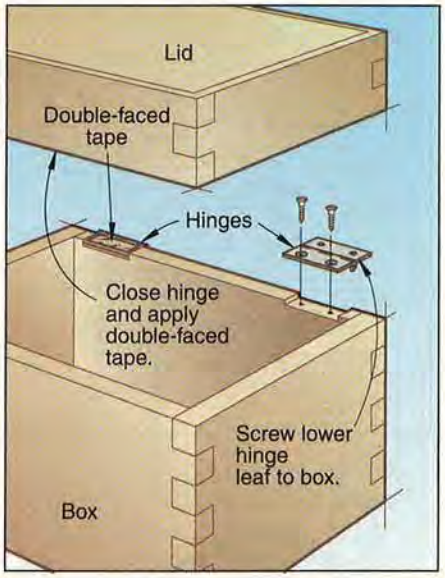
Hold shifty lids in place with double-faced tape

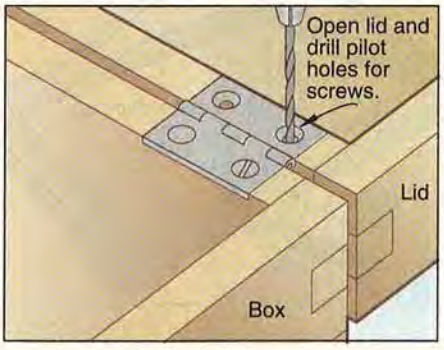
Aligning a hinge with the lid of a box while you try to drill the holes for the hinge screws often proves tricky. Here's a solution that's fast and simple.

First, cut your hinge mortises, and screw the hinges to the box. Next, place a strip of double-faced tape on the top of the hinge, and align the lid in the closed position on top of the box. Press firmly over the hinge to get a good bond between the lid and the tape.

Then, carefully open the lid and drill the pilot holes for the hinge as shown *below*. Remove the lid from the hinge and take off the tape. Now, reinstall the lid by driving the screws through the hinge and into your perfectly aligned pilot holes.

—Alan Holtz, Torrance, Calif.



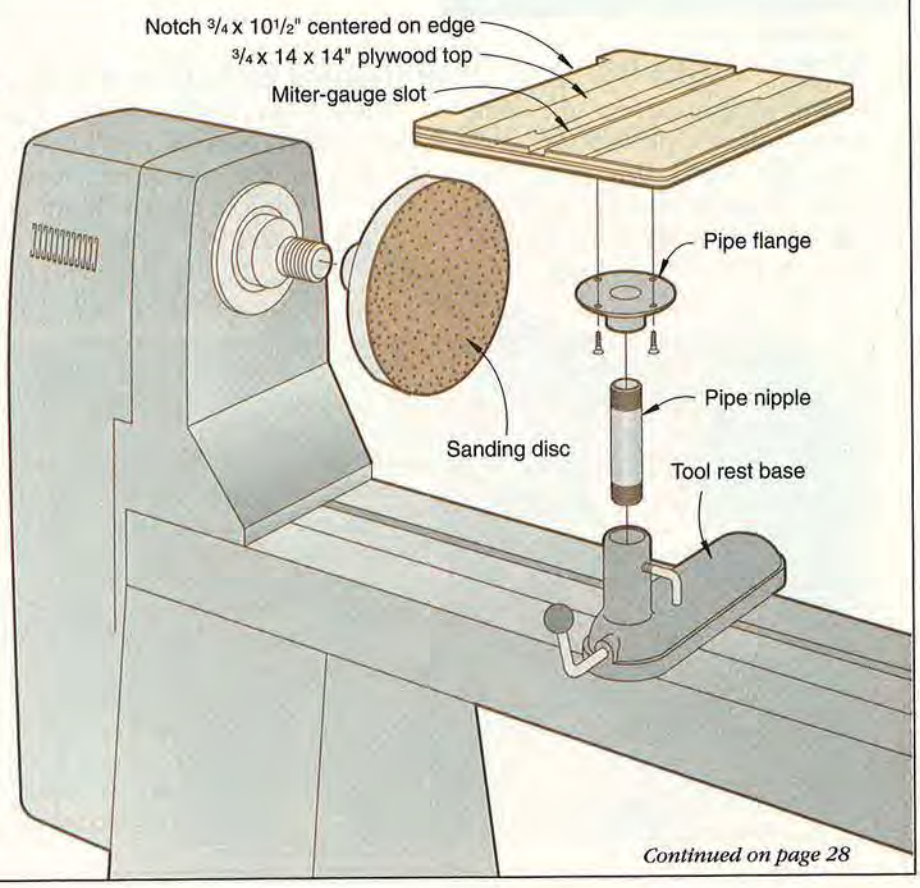


Turn to your lathe for a low-cost sanding disc

If you need a sanding disc and table, but your budget or available workshop space won't allow another stationary-machine purchase, build one like this for your lathe. To make the disc, cut out a 10"-diameter circle from a flat piece of ¾" hardwood plywood, and mount it to the faceplate of your lathe. Then, cut a 10"-diameter piece of sandpaper and adhere it to the disc.

Now, build a 14×14" table as shown *right,* also from ¾" hardwood plywood, and rout a ⅜"-deep, ¾"-wide miter-gauge slot down the middle. Mount the table to the lathe using a pipe nipple and pipe flange. Choose a pipe nipple size that fits snugly into your tool rest clamp.

—V. L. Burgess, Titusville, Fla.



Continued on page 28

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By Ron Bishop

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Go ahead. Feel the balance. Feel the power. Challenge this drill with your toughest projects. If it doesn't *exceed* your expectations, I insist you return it within 30 days for a no-questions-asked refund. Your satisfaction is guaranteed.

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Circle No. 43

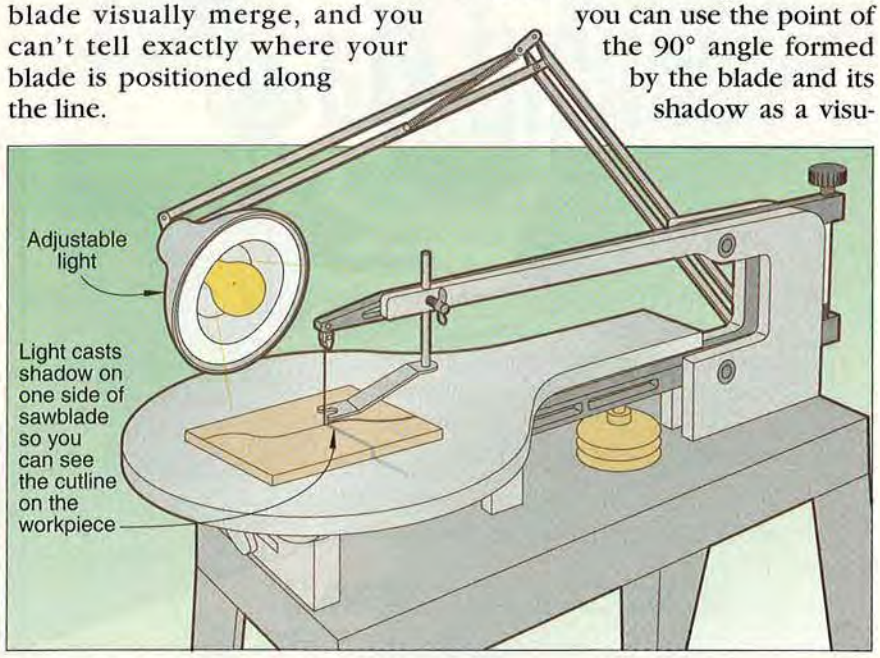
Continued from page 27

Right-angle lighting illuminates scrollsaw cut

Scrollsawing a pattern line sometimes causes a perception problem. The black line and black blade visually merge, and you can't tell exactly where your blade is positioned along the line.

Place a lamp as shown so that your blade casts a right-angle shadow on the workpiece. Now, you can use the point of the 90° angle formed by the blade and its shadow as a visual reference rather than trying to distinguish between the blade and the line.

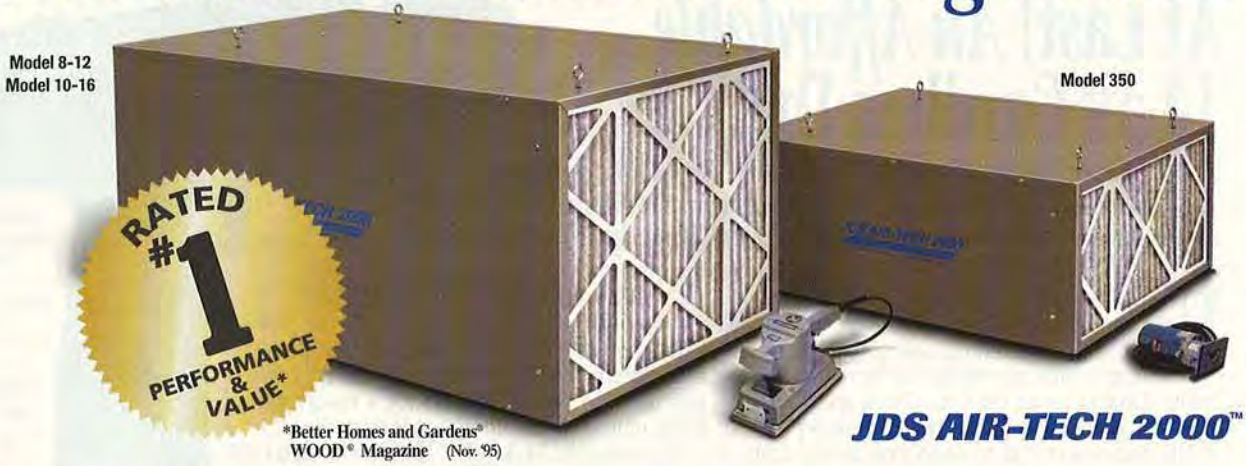
—John Harris, Sun City, Calif.



A FEW MORE TIPS FROM OUR WOODWORKING PROS

- On *page 39* craftsman Michael Elkan shows you how to make and use simple scrapwood aids to get more clamping help with your projects.
- See *page 75* for tips on getting the most usable stock from severely warped boards.
- Create splined mitered joints using the techniques shown in the clock project on *page 63*.
- Check out our procedure on *page 46* for checking the fit of mortises with a piece of paper.

Give Yourself Some Breathing Room.



*Better Homes and Gardens® WOOD® Magazine (Nov. '95)

Recent medical studies show that breathing wood dust can be hazardous to your health. The JDS AIR-TECH 2000 will dramatically improve the quality of the air in your workshop.

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WOOD ANECDOTE

Print this article

BLACK CHERRY

Bears and backwoodsmen appreciated more than its wood

Today's woodworkers know black cherry as one of the finest cabinet woods. Costing nearly as much as black walnut, its price reflects its reputation. But in its use as well as its cost, some things have changed through the centuries.

Early American craftsmen often substituted black cherry for hard-to-get mahogany, wiping the wood with a solution of nitric acid, colored pigment, and red wine to hasten its darkening. In its natural color, black cherry also was popular for the paneling in Pullman cars and carriages. And because the wood took a high polish, it frequently became the stock for caskets. Daniel Boone was said to have made three such caskets, and in his old age occasionally slept in one.

Yet, for all of its woodworking popularity, black cherry was better known on the frontier for its fruit. Mountaineers mixed its juice with rum or brandy for a bitterly pleasant drink called cherry bounce. The plentiful bears of those bygone days also coveted the dark-purple cherries. So determined were they to shimmy up a tree for them that pioneers knew enough to leave the "cherry bears" alone because they became especially cranky when interrupted.

Black-cherry bark was valuable back then, too. It contains a type of astringent acid that for generations contributed to cough and sore-throat medicines. Even by chewing the raw bark the ailing relieved many cold symptoms.

Small and juicy, the fruits of the black cherry tree attracted both men and animals.

Illustration: Jim Stevenson

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Whether your woodworker's license reads "Beginner," "Intermediate," or "Advanced," you're bound to have a few questions about your favorite hobby. We can help by consulting our staff and outside experts. Send your questions to Ask *WOOD®*, *Better Homes and Gardens® WOOD* Magazine, 1912 Grand Ave., Des Moines, IA 50309-3379. *CompuServe:* 74404,3516 (or) *Internet:* 74404.3516@compuserve.com

A new angle on mitering moldings

I am planning a stereo cabinet with an arched section of molding on the front edge. How can I calculate and cut the miter angle where this arch meets the straight molding?

—John Beauvilliers, West Milton, Ohio

John, here's the procedure we recommend you use to cut the miter for the arched molding/straight molding joint:

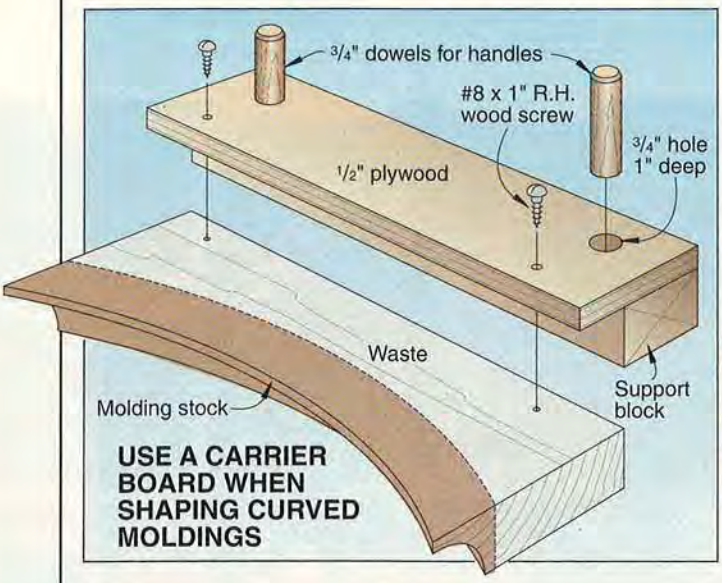
1 Make a scale drawing of the molding sections. Next, draw a rectangle around the drawing of each molding piece. Measure this rectangle to determine the size of board needed to make the moldings. Make the squared molding stock sections large enough to allow fastening a carrier board to the stock for safer profile shaping on the curved sections (see drawing *below left*).

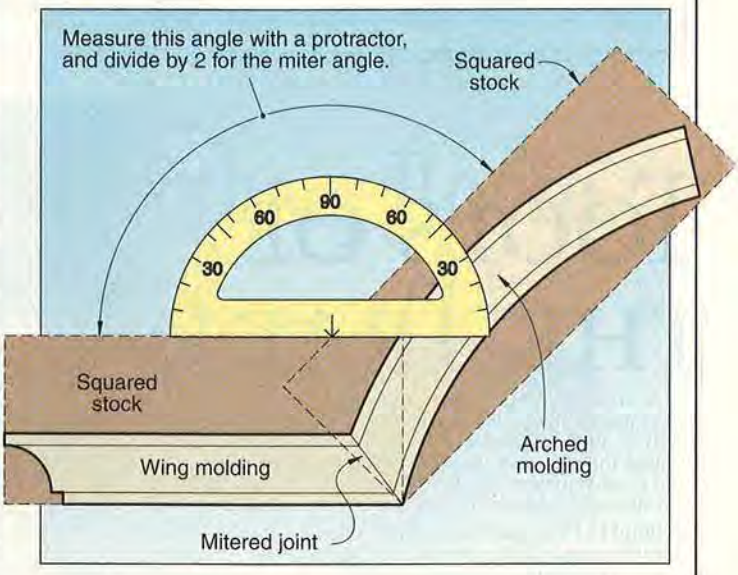
2 Use a protractor to measure the inside angle of the joint of the squared stock (see drawing *below right*). Divide the protractor reading in half to obtain the miter angle.

3 Bandsaw the inside curve of the arched molding pieces. Then, cut the molding profile on both the straight and curved sections using your router table or shaper. Use a router bit with a ball-bearing pilot or a shaper cutter with a rub collar to cut the profile on the curved molding sections. (It's also a good idea to use a guide pin when cutting curved moldings on a shaper.)

4 Place the straight top edges of the molding stock against your miter gauge and cut the miters on both the straight and curved moldings.

5 Finally, cut the moldings to width, using the bandsaw on the curved molding and the tablesaw on the straight.





If not polyurethane, then what?

In the Wood Profile on eastern (aromatic) red cedar in the April 1994 issue, you say not to use polyurethane or plastic finishes on this wood. However, you do not say what can be used. What finish would you suggest I use on my cedar chest?

—Richard A. Kern, Drury, Mo.

Rich, we have heard many horror stories of woodworkers having to strip a sticky or cracked polyurethane finish off their newly-built cedar chest. That's why we prefer to use tung oil or another penetrating oil finish on this wood. These finishes will blend with the natural oils in eastern red cedar rather than react to them.

You also can use any non-polyurethane oil-based varnish on this wood. Tung oil varnish, spar varnish, and finishes such as Behlen 4 Hour Rubbing Varnish will produce a beautiful finish on cedar. Just be sure to varnish only the outside of your project if you want the cedar aroma on the inside.

Continued on page 32

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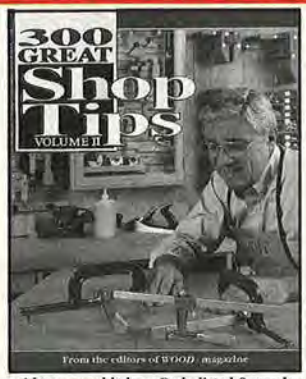

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DeWalt 8-1/2" & Ryobi 8-1/2"x60Tx5/8"	$179	$109
Delta 9"x80Tx5/8"	$204	$119
Ryobi–Makita & all 10"x80Tx5/8"	$207	$129
DeWalt, Makita, B&D, Hitachi 12"x80Tx1"	$229	$139
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For good general purpose cuts use Woodworker II 30T & 40T or Woodworker I. Use small stiffener where possible.

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>
> **P. Rose, PA**
>
> After installing your blade and 5 in. stiffener the vibration in my saw went down another 20%. I ran several pieces of hardwood through the saw, both **crosscut** and **ripping**, and was amazed at the smoothness. It was like cutting butter, maybe smoother. I have never had a saw blade that **cut this smooth.**
>
> I also am going to send you my old Craftsman blade to sharpen. I'm not satisfied with our local sharpening. Now, how to **justify another one** of your blades.... because **I don't ever want to be without one.**
>
> **Rick Price**

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Circle No. 1322

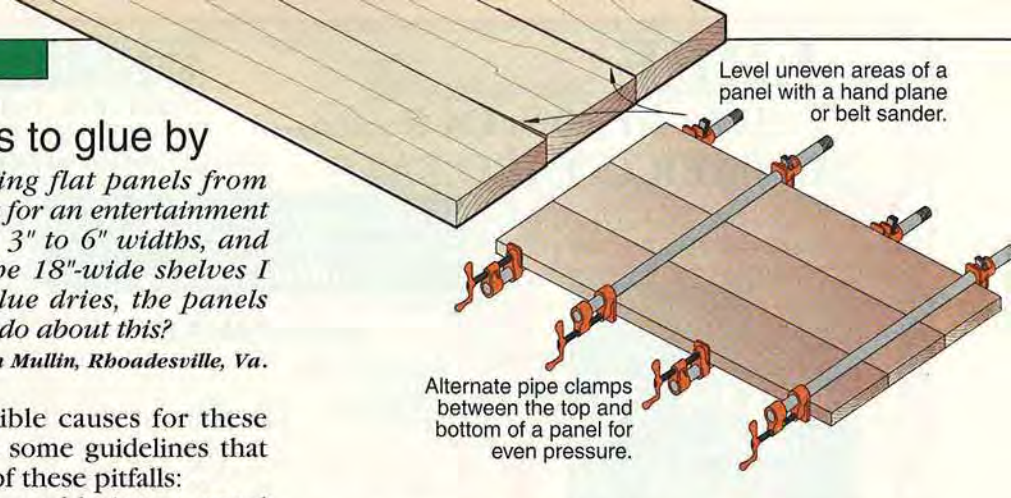
ASK WOOD

Continued from page 30

Here are some rules to glue by

I am having problems getting flat panels from boards that I am edge-joining for an entertainment center. I rip the boards into 3" to 6" widths, and glue them together to get the 18"-wide shelves I need. However, when the glue dries, the panels come out twisted. What can I do about this?

—John Mullin, Rhoadesville, Va.



John, there are several possible causes for these twisted panels. And here are some guidelines that should help you evade some of these pitfalls:

1 Cut the boards you will assemble into a panel two or three days ahead of the gluing time. Stack and sticker these boards, and allow them to stabilize before you edge-glue them into panels. Select the straightest of these boards for making the panels, saving the warped pieces for smaller projects.

2 Be sure your pipe clamps are sitting on a flat surface when you assemble the panel. An uneven surface or misalignment of the clamps can force a curve or twist into the glued-up assembly.

After the glue has dried, stack and sticker the panels, and allow them to stabilize for a few days. Then, flat-plane or discard any twisted panels.

3 Don't force a slightly curved or warped board to lie flat and even with the surface of other boards in the panel. A twisted board that has been forced flat will spring back toward its original shape and apply uneven tension to the entire panel. If you must use a warped board in a panel, it's better to allow some surface unevenness while gluing. When the glue has dried, the part of the twisted board that sticks up above the surface of the other boards can be removed with a hand plane or belt sander.

4 Alternate your clamps between the top and bottom of the boards when gluing. This evens out the clamping pressure and helps prevent clamping a curve into the panel.

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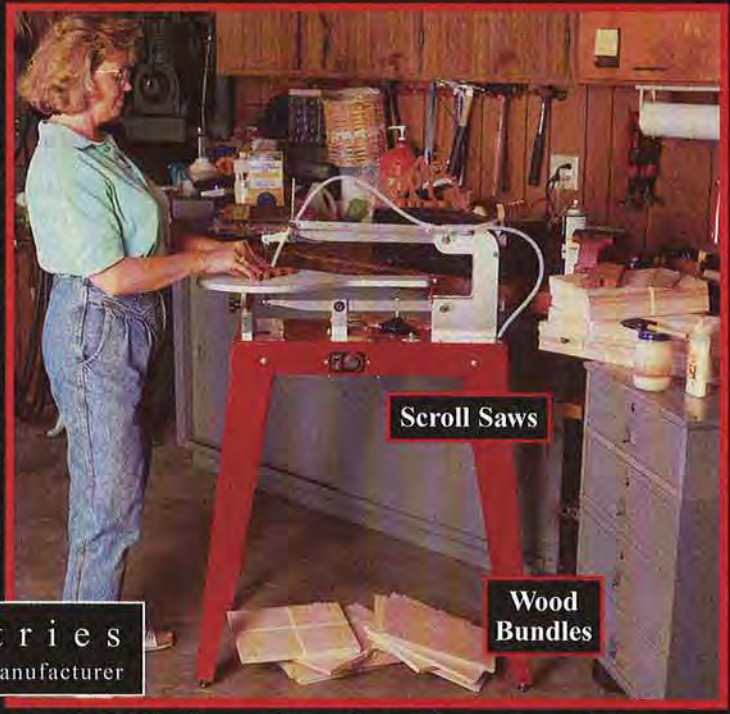

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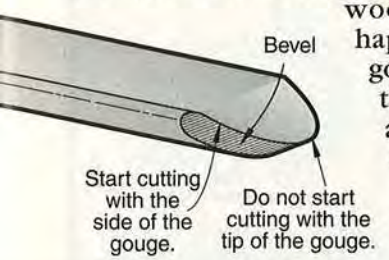
Jumpin' lathe tools!

I often get the daylights scared out of me when my gouge or other turning tool digs into the end grain of the bowl I am turning. Can you tell me how to correct this problem?

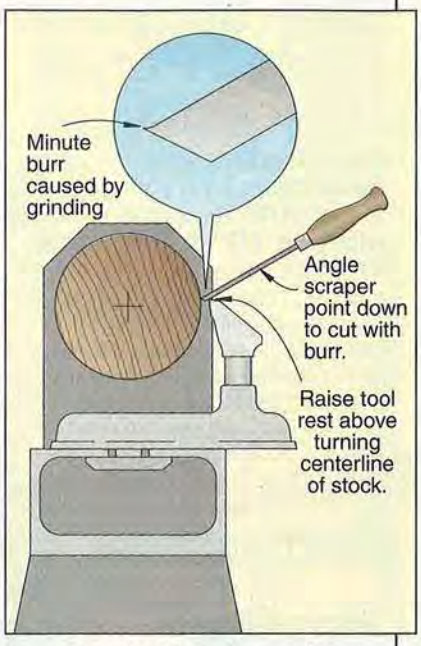
—R.M. Weaber, Panama City, Fla.

What you're describing usually happens when you hold a lathe tool at the wrong angle in relation to the turning workpiece. And the way you hold the tool depends on whether you use gouges or scrapers for your faceplate work. Here's a pointer for using each type of tool that should make life at your lathe a bit more peaceful.

1 Start cutting with a bowl gouge by resting the bevel against the side of the spinning bowl blank. Then, roll the cutting edge of the gouge into the wood. The cutting should happen on the side of the gouge rather than the center. Cutting with the side allows the gouge to cleanly shear the wood fibers. Cutting with the tip facing up will cause the gouge to catch in the end grain and jump. Cutting with the tip down will result in a scraping action and a rougher and slower cutting process. (See drawing *below left.*)



2 Scraper tools cut with a minute burr caused by sharpening the scraper on a grinding wheel. (You can feel this as a little bit of roughness on the top edge of the scraper point after grinding. Don't remove this with a stone.) Raise the tool rest above the center of the turning, and angle the scraper downward so the cutting point is lower than the handle for cutting (see drawing *above*). This allows the minute burr on the edge of the scraper to cleanly shear the wood without the tool catching and gouging your turning.



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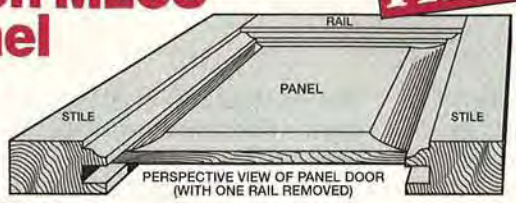

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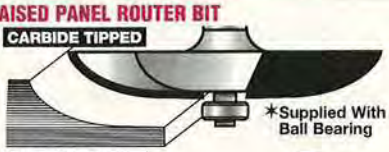
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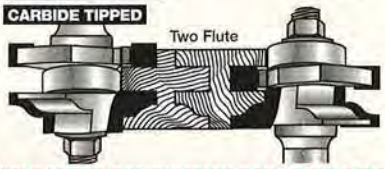
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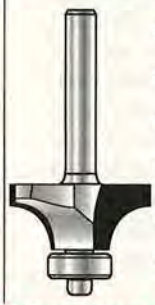
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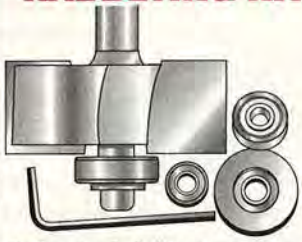
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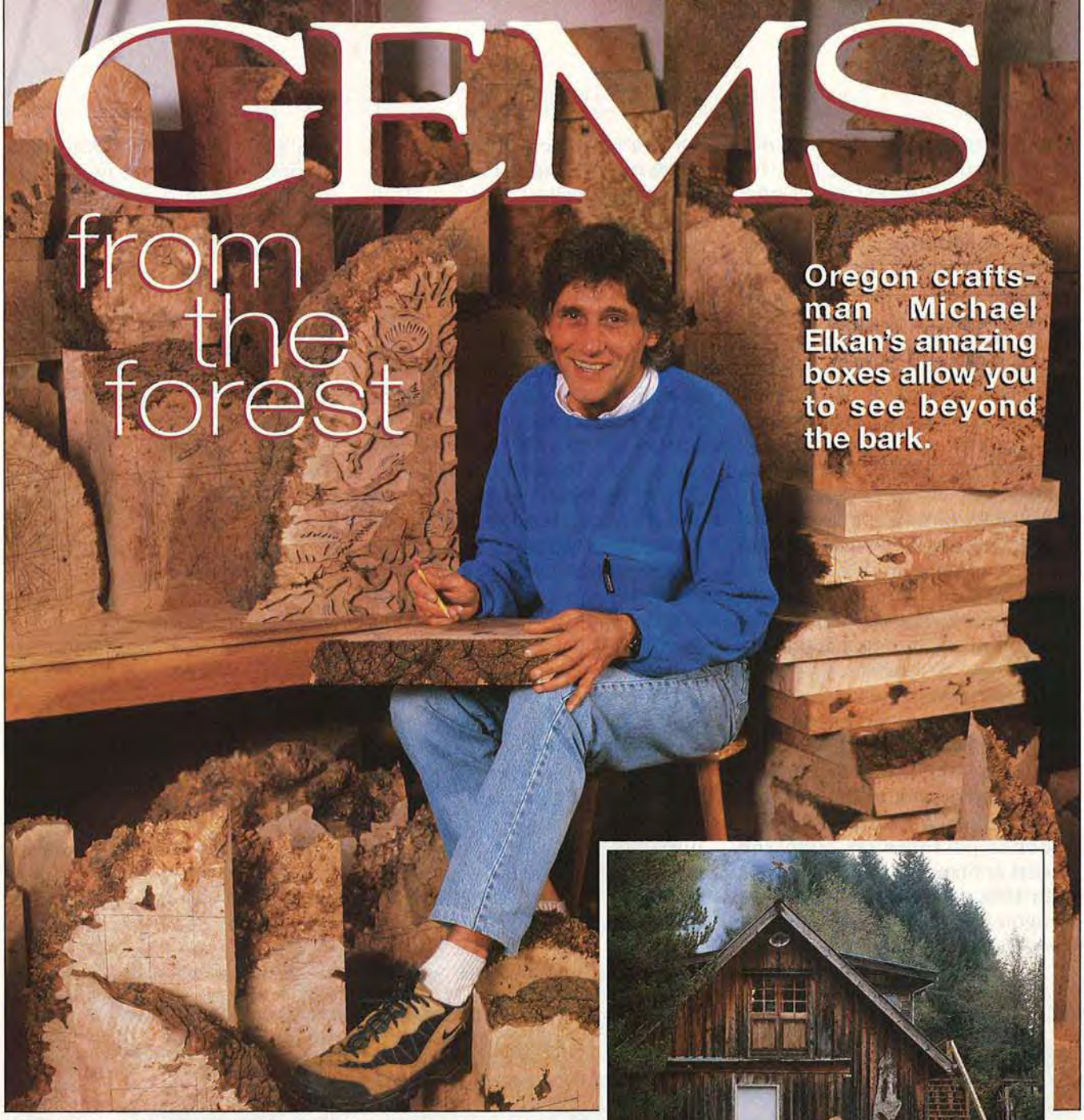
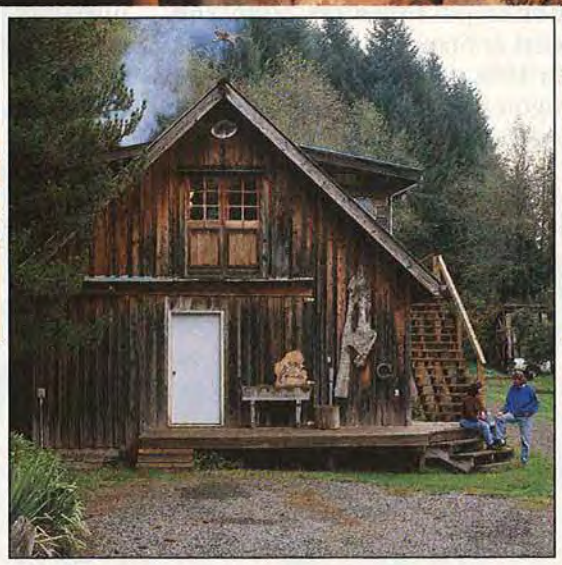
GEMS from the forest

Oregon craftsman Michael Elkan's amazing boxes allow you to see beyond the bark.





Above: **Michael Elkan allows plenty of time to shape ideas for his sculptural bandsawn boxes. He'll refine and refine a sketch until it suits the character of the stock.**
Right: **In the foothills of the Cascade Range, a once run-down, two-story greenhouse now houses the Elkan Studio.**

Reading the wood, that's what Michael Elkan calls his ability to transform oddballs of wood from California and Oregon forests into gems—intriguing, sculptural boxes with multiple compartments. He takes what in years past most lumbermen would leave behind—root and trunk burls—studies them, then at his bandsaw expertly cuts them apart, only to reassemble them in astonishing fashion. For the transformation, admiring buyers pay him as much as $5,000. But the work that now comes from Michael's Silverton, Oregon, studio represents an 18-year evolution, and his own transformation.

From Manhattan canyons to Cascade foothills

At 5'11", with a lean frame that evidences his fondness for exercise, Michael looks the part of someone who loves the woodshop. Frayed and faded jeans. A rumpled sweatshirt sprinkled with

Continued

Print this article

"I don't use templates for the boxes,

sawdust. An ever-present pencil protruding from tousled hair. It's hard to imagine that this lanky, 50-year-old woodworker once occupied an office in New York City's Empire State Building.

Nevertheless, that's where his story begins. During the late seventies, Michael was at the top of the profession in apparel design. That was pre-Calvin Klein, pre-Ralph Lauren. And he was barely 30 years old.

Yet, Michael had already put in a full career's worth of years in the apparel field. He had begun working at his father's Philadelphia clothing store as a seven-year-old, and stayed in the industry to move from retail to manufacturing, and finally to fabric and clothing design. "I'd spent 23 years in the garment industry by the time I was 30, and I was getting burned out," says Michael.

So, Michael got out. He and his wife, Sharon, sold everything and set out to explore the possibly greener pastures far from the streets of Manhattan.

"In 1978, we arrived in Silverton, Oregon. We had a nest egg, but no idea what we were going to do to earn a living after that was gone," he recalls.

But the area—as it is yet today—was rural, unhurried, and beautiful. The rich Willamette Valley soil supported an abundance of crops, from grapes to berries, apples, and corn. To the west, the Coast Range begged a climb over to the ocean. On the east, the Cascade Range rose above a forest sea.

Michael and Sharon found a home—a 15-acre site carved out of the Cascades' foothills. There was a classic old farmhouse set on a stone foundation, a barn, and a stable. The large greenhouse needed plenty of work, but today houses Michael's studio. Nearby Silver Falls, and the often fog-shrouded, forested ridges, offer solitude as well as inspiration.

"With the place, I had inherited an old multi-machine that combined a tablesaw and a lathe," Michael recalls. "So, I began playing around making things, some turned boxes that I did with a carpenter's chisel, some furniture. I hadn't settled on anything, but I liked working with my hands."

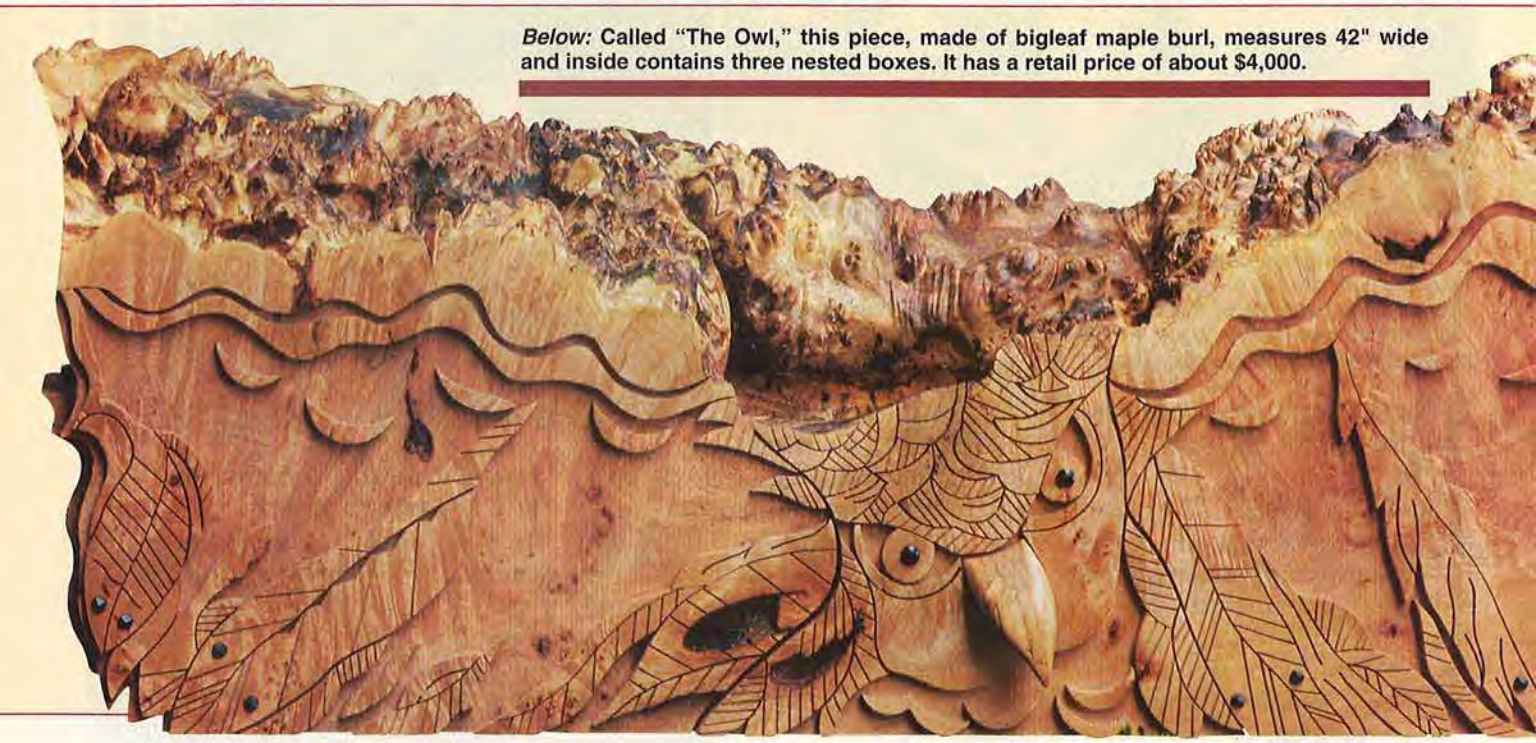
As Michael tells it, a local friend dropped in one day, saw what he was doing, and suggested that he buy a bandsaw. Michael ended up with a homemade variety that had a 36" throat. His boxes were born.

In the beginning: The $1,000 summer

"My friend Ross, who had talked me into the bandsaw, liked what I was doing," Michael remembers. "He ended up convincing me to demonstrate at the state fair."

In the late seventies, the craft movement was just gaining momentum, and the fading summer of 1979 marked the first attempt at a craft show as part of the Oregon State Fair. For Michael, Sharon, and Michael's brother Chuck, who had joined them, it was the launch of another career. Although at the time, it was a bittersweet milestone.

Michael remembers, "We set up in the craft area—no booth fee, no commissions—as kind of entertainment. We had the bandsaw and everything we had made so far—boxes, some chairs, some coffee tables. Well, we sold every-



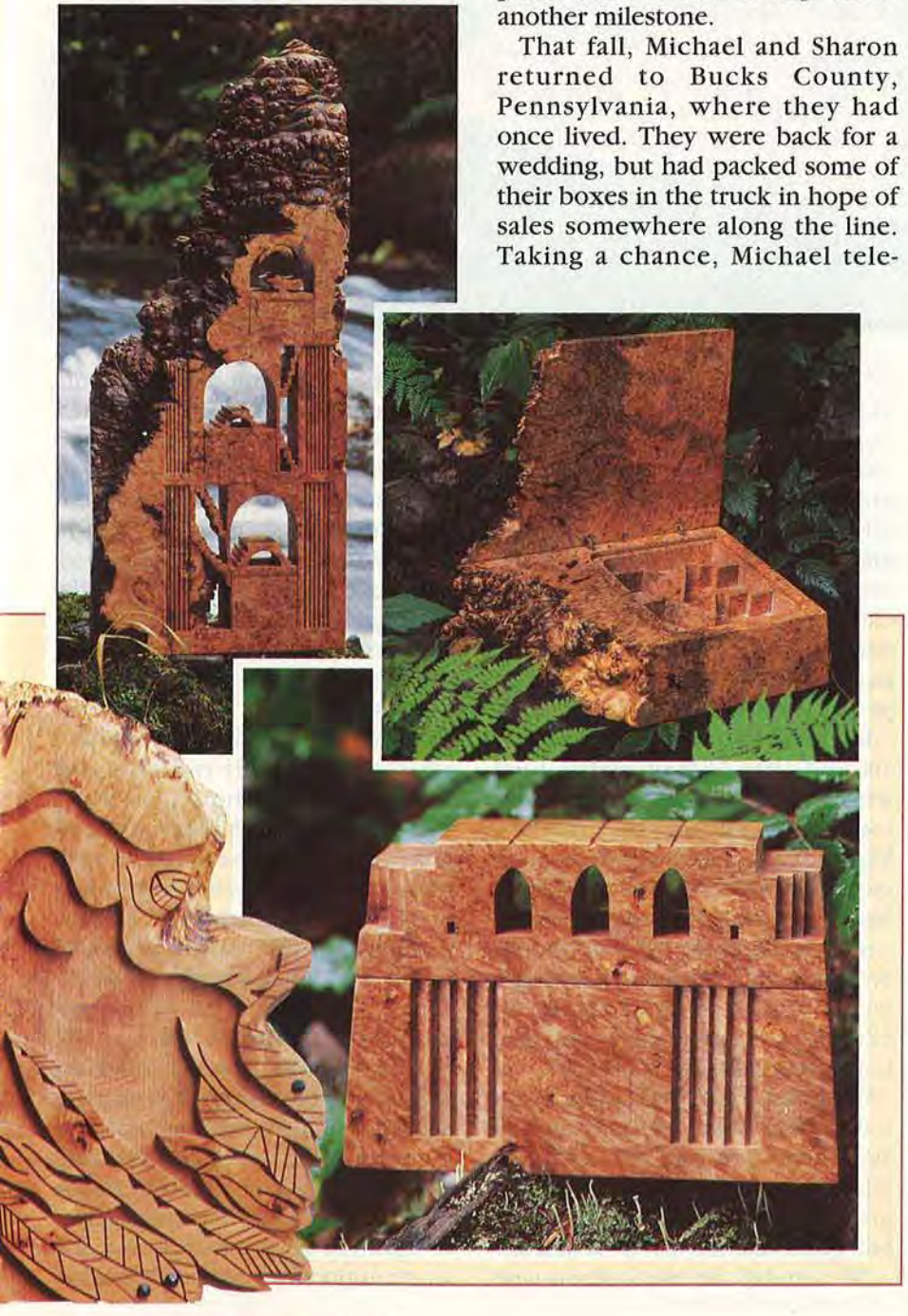
Below: **Called "The Owl," this piece, made of bigleaf maple burl, measures 42" wide and inside contains three nested boxes. It has a retail price of about $4,000.**

I design for each piece of wood."

Top: **An architectural-style box, "No-Way Stairway" stands 36" tall. It will sell for about $1,500.**

Middle: **This 12×14" natural-edge jewelry box has a removable tray and hinged lid. At retail, you could buy one like it for $250.**

Bottom: **This tall keeper-style box, reminiscent of a castle, has a lid that comes off. It's about 10" wide and sells for around $150.**



thing in two days, and it was a 10-day fair! Here I had been in multi-million-dollar businesses all my adult life and all I had to show for a summer's worth of work was about $1,000. But I could tell we were onto something because we were selling everything we put out, making it right there!"

After the fair, Michael stepped up his work and started refining processes. Then along came another milestone.

That fall, Michael and Sharon returned to Bucks County, Pennsylvania, where they had once lived. They were back for a wedding, but had packed some of their boxes in the truck in hope of sales somewhere along the line. Taking a chance, Michael telephoned the late George Nakashima, a woodworking legend who he had read about in magazines. Nakashima's studio and gallery just happened to be in Bucks County. Michael asked for an appointment, and a favor if the master would critique his work. Surprisingly, Nakashima agreed.

"I got to Nakashima's studio early on the day of the wedding," Michael says. "My name wasn't in the appointment book. I told the receptionist I'd wait. Finally, George came out. He was dressed in a kimono and really had a presence about him. I jumped up and told him who I was, but he'd never heard of me. At last, he told me to bring in some pieces.

"So I went out and brought back this huge carton of boxes and started unwrapping them," Michael continues. "We ended up talking a couple of hours—with frequent interruptions. But during them, people were buying my boxes. Before I left, George said he'd take 10 pieces to sell in his studio. Then, I handed him a client's personal check made out to him for a couple of the pieces I'd just sold there. He glanced at it and said, 'You didn't take tax.' I'll never forget that."

The meeting with Nakashima didn't turn into a major outlet for Michael's bandsawn boxes. He ordered only one more time, but as Michael puts it, "I believe he wanted to give me the jump start to get going. Before that, I hadn't really thought of what I was doing as a business. But I figured that if George Nakashima had enough appreciation for my work to carry it, that was enough for me. From then on, I began actively placing my work and exhibiting."

Let the wood speak

Since that visit to George Nakashima 17 years ago, Michael and Sharon have built their busi-

Continued

With chalk, Michael traces the possible saw cuts that will transform the slab of burl into a box with multiple compartments highlighted by architectural elements.

Above: Each natural-edged burl must be hand-cleaned of its bark, a laborious, time-consuming process.

Right: To bandsaw the slab of burl at an angle, Michael uses a scrapwood shim rather than taking the time to tilt the table.

ness to 300 wholesale accounts. Elkan boxes and other products such as hand mirrors and desk accessories can be found in shops and galleries across the continental U.S., and in Hawaii, Europe, Hong Kong, Korea, Japan, and the Bahamas. The work has come a long way, and there's a lot of it, yet each piece still carries Michael's touch, because he's the one who reads the wood.

"When I started doing this, burls weren't even considered good firewood because they wouldn't split," says Michael. "But I was intrigued by them. The first ones I saw were 6-8"-diameter ones of vine maple that Sharon and I found on the property. I cut them in half on the tablesaw, and couldn't believe what incredible material it was.

"Then there were some alders leaning over the barn that I cut down. I just cut them and let them lie. Months later, I opened up the wood. It was spalted [decaying with coloration], even though I didn't know that word back then. I thought it was great.

"After that, the boards I saw in lumberyards all looked pretty boring." In fact, the classic woodworking woods—walnut, cherry, maple—were so boring to Michael that he set out to find more of the unusual. He discovered a local wood dealer who specialized in selling burls of bigleaf maple, and redwood for clock faces. Michael ended up buying 50 pallets of them.

Little by little, the word got around that "Elkan wants burl wood." People began to call, and loggers stopped by. Today, Michael's supply channels are more defined. "You pay for burls by the pound," he says, "from 15 cents to about $1.50, depending on their quality. So reading the wood begins on the outside, to check for rot and ingrown bark, both undesirable."

Michael calculates that his inventory of burl may be as much as 50,000 pounds, stored in outbuildings. And any one piece of burl may sit around quite awhile before its turn comes to be used.

"We air-dry the wood for a year or so before it goes in the kiln," Michael explains. "The kiln-dried burls are then bandsawn into 3-12"-thick slabs and run through the planer. Then, I just stand them up around the staging room until I get an idea for a box.

"I don't use templates," he adds. "I design for each piece of wood, but because I'm starting with a burl, I have to go with what it is going to yield. It's what the wood has to say, the way the grain runs—whether it radiates out from the center, how it swirls—that decides. And even after 18 years and the help of a few employees, I'm still touching every single burl that comes through, and it's still mostly the wood that dictates its final shape."

Concepts in the stock

On any given day, you'll find Michael prowling the staging room amid the standing slabs of burl. He'll stop occasionally, pull out a pencil or chalk, and sketch on a particularly appealing chunk.

"I start with a concept. But it's an evolutionary process that takes

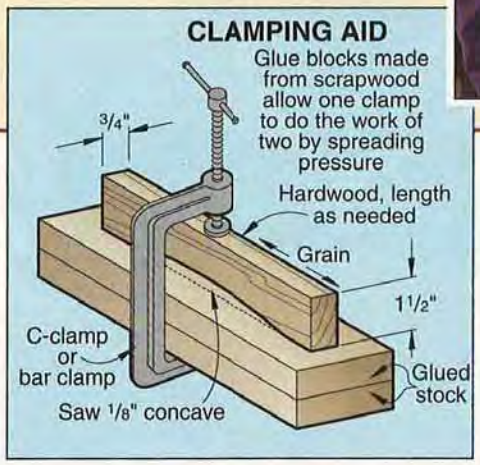
Right: **At her bandsaw, Sharon displays her design skills on the boxes by adding details and making the intricate inside cuts with a ¼" blade.**

Right: **Assistant Susan Marcoe has the unenviable job of gluing, fitting, and clamping the many pieces of a box together. She prides herself on invisible glue lines in the burl figure.**

drawings and more drawings right on the wood until I feel it's ready to become something," Michael says as he pauses to sketch.

When Michael deems a burl ready, it's he who does the initial bandsawing. "I use a 36" bandsaw with a ½" blade for the shaping," he notes. "And rather than adjust the table for angled cuts, I slip a precut shim under the slab. It's a lot faster that way." (See *above.)*

At the bandsaw, Michael proves his reading of the wood. He explains: "I'm trying to put the work [a box] into a defined shape that I've drawn, but the material doesn't always want to be contained in that shape. So I let it blossom out in places as a free-form natural edge. See, I may want it to be a rectangle, but in places the wood can't be contained. The end product is still recognizable as a rectangle or square, yet it's not totally so. That's what makes our concept of boxes different—not completely restraining the wood. If I've read the wood correctly, it has a natural look and appeal."



After Michael has defined the burl box's shape, Sharon takes over at another bandsaw. With its ¼" blade, she cuts out the panels and further slices the burl into little compartments and doors. She adds her own innovations, too, such as the angled cuts that often define an architectural motif. Or, she includes symbols of an animal or plant. "We combine architecture with natural things, to give the boxes life," she says.

Susan Marcoe, a five-year veteran at the Elkan Studio, eventually ends up with all the little pieces, slices, and slabs that will be a box. She carefully applies yellow glue to all the joints, then begins the assembly process, frequently using a dozen or more clamps on an intricate piece. Helpful, too, are the clamping aids Michael devised (*left*), which make one clamp do the job of two.

A glued-up box then goes down the line for hinges and a finish-sanding. At the last stop, the finishing room, Rick Greenman applies two coats of Nelsonite, a clear, oil-based penetrating oil and wood stabilizer. Finally, each box gets a hand-rubbed coat of paste wax. In the Elkan Studio, no wood sees a stain.

"I like wood in its natural state," comments Michael. "In that way, maybe I'm trying to do what George Nakashima did in his work—show a true reverence for the wood."

Learn to read the wood

Michael's new book, *Reading the Wood* (1995, Sterling Publishing Co., New York), is available at bookstores. To order an autographed copy from Michael, send $19.95 (US), plus $3.50 shipping, to Elkan Studio, 22364 North Fork Rd., Silverton, OR 97381.

Written by Peter J. Stephano Photographs: Laurie Black Drawing: Roxanne LeMoine

Sweet-dreams DOLL

CRADLE

Start with the basket ends

1 To form the wide end-panel blanks (A), edge-join enough ¾"-thick stock to form a pair of blanks measuring 14½×16". (To do this, we glued and clamped two 7¼×16" pieces edge-to-edge. This centers the joint line on each end panel where shown on the Exploded View drawing.)

2 Crosscut the bottom end of each end-panel blank (A) for a straight edge. Mount a ¾" dado blade in your tablesaw, and tilt it 8° from vertical. See Cutting the Dado drawing *below* for reference. Now, cut a ¾" dado ¼" deep 5/16" from the bottom edge along the bottom inside face (good face up) of each end-panel blank where shown on the drawing.

3 Cut the full-sized end panel (A) half-pattern to shape from the *WOOD PATTERNS®* insert in the center of the magazine. Transfer the full-sized half-pattern to a second piece of paper, and cut it to shape. Tape the two half patterns together to form a full-sized pattern. Position the paper pattern on the outside face of each end-panel blank, and trace the outline onto each blank. Use an awl to transfer the centerpoints for the 1" hole and the seven screw holes onto each panel blank.

4 Construct a support to hold each end-panel blank 8° from horizontal. Clamp the support to your drill-press table. Now, drill a 1" hole at an 8° angle, centered on the top end of each end panel where marked in the previous step and shown in the photo *below*.

Using an angled support on your drill-press table to position the end-panel blank at 8°, drill a 1" hole in each one.

5 Remove the angled support from your drill-press table. To drill the screw-mounting holes, chuck a ⅜" bit into the drill press. Drill a ¼"-deep hole at each remaining marked centerpoint on the outside face of each end-panel blank. Switch bits, and drill a 5/32" shank hole through the center of each ⅜" counterbore. See the Screw Hole detail accompanying the Exploded View drawing for reference.

6 Using double-faced tape, adhere the two end-panel blanks inside face to inside face, with the edges and 5/32" and 1" holes aligned. Using a bandsaw, cut the end panels to shape, cutting just outside the marked line. Now, using a drum-sander and a 2½" or 3" drum, sand to the line to remove the saw marks and finish shaping the panels. Pry the pieces apart, and remove the tape.

Cut the bottom, top rails, and dowels

1 Edge-join enough stock to form the basket bottom (B). Later, cut the basket to finished size (12 1/16×22 9/16"), ripping the edges at 8° where shown on the Section View detail *below*.

2 Carefully mark the centerpoints for the ⅜" dowel holes along the outside edges of the basket bottom (B). Chuck a ⅜" brad-point bit into your drill press. With the angled support used earlier, support the bottom (B) on it, and drill ¼"-deep holes at an 8° angle where marked.

3 Sand the basket bottom (B) smooth, sanding slight round-overs along the edges (not ends) where shown on the drawing.

4 Cut the top-rail blanks (C) to size, mitering the ends at 8°. Duplicate the half-pattern, and adhere the full-sized patterns to one of the blanks.

5 Clamp the two top-rail blanks face-to-face, with the edges and ends flush. Bandsaw the bottom edge (not the top) to shape. Sand the cut edge smooth. Using the full-sized top-rail half-pattern for reference, transfer the hole centerlines across the bandsawn edge of

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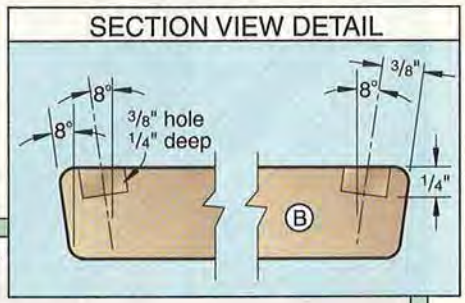

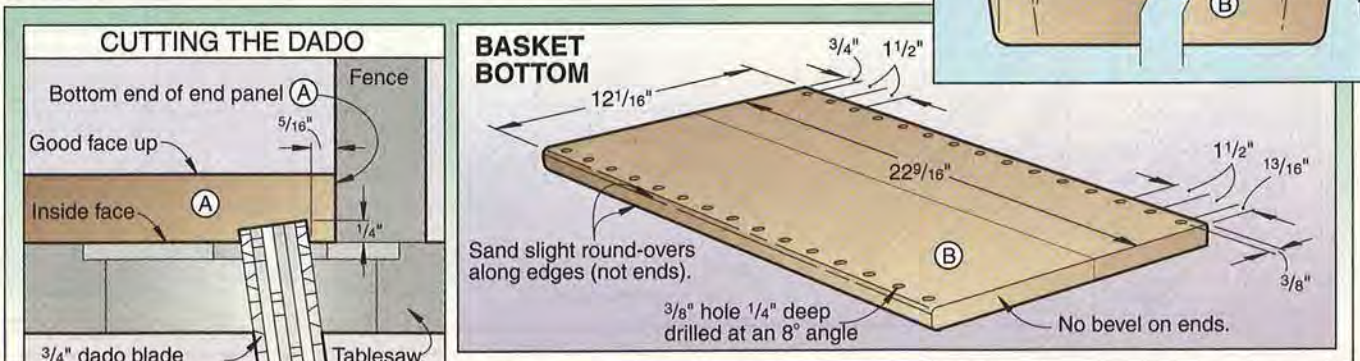

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both pieces with a square. Fit your drill-press with a ⅜" brad-point bit, and drill ¼"-deep holes centered along the bottom edge of each top rail as shown in the photo *below*.

Mount a fence to your drill-press table for accurately centered holes in the bottom edge of the rails.

6 With the pieces still taped-together, bandsaw and sand the top edge of the rails to shape. Separate the pieces and remove the tape and paper pattern.

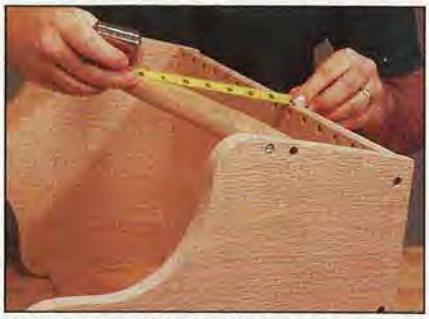
7 Mount a ½" round-over bit into your table-mounted router, and position it to rout a partial round-over where shown on Routing a Partial Round-Over detail accompanying the Exploded View drawing. Rout just the top edge of each top rail where indicated on the Exploded View drawing.

Finish forming the cradle basket

1 Temporarily screw the basket assembly (A, B, C) together. As shown in the photo *below*, measure the distance between the holes in the basket bottom (B) and the top rail (C). Add 7/16" to each measured length, and cut the ⅜" side dowels to length.

2 Reassemble the basket to test-fit the ⅜" dowels. Then, glue and screw the basket together. Plug the screw holes, and sand the plugs flush.

3 Cut a pair of 1" dowels to 2" long, miter-cutting one end of each at 8°. Sand a slight chamfer on the non-mitered end of each 1" dowel. With the mitered end of the dowel flush with the inside face of one basket end, glue the dowel in place. Repeat for the other end.



Measure the distance between opposing holes in the pieces and add 7/16" to determine the length of each dowel.

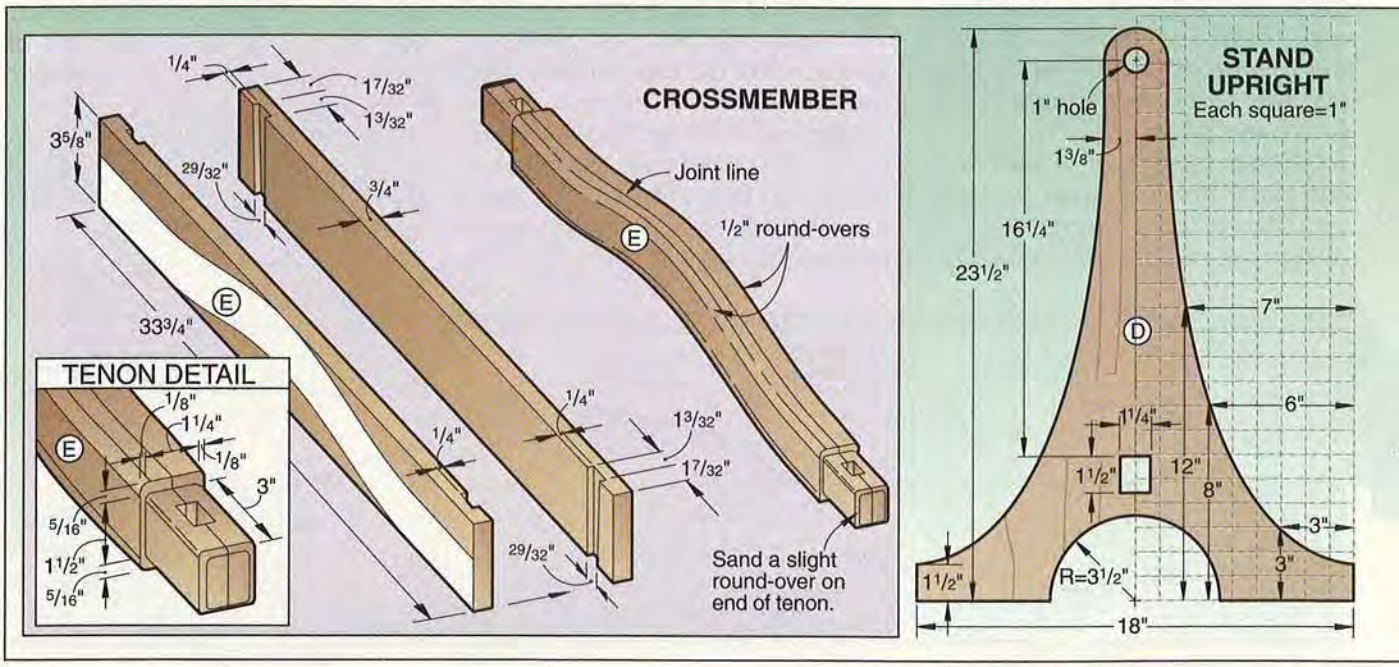
Form the stand to support the basket

1 Edge-join stock to form the upright blanks (D). Trim the bottom edges of both blanks. With the bottom edges flush, use double-faced tape to secure the two blanks together face-to-face. Using the Stand Upright drawing for reference, transfer the shape to one of the blanks. (We used a thin piece of wood to form smooth curves to join the four points dimensioned on the drawing. Don't worry about your shape being exactly the same as ours. Just make sure the shape is the same on each side of the upright.)

2 Bandsaw and sand the taped-together uprights to shape. Pry the blanks apart, and remove the tape. Mark the 1" hole centerpoint and mortise location on each upright. Drill the holes and cut the mortises to shape.

3 Cut two pieces of ¾"-thick stock to be joined face-to-face later, to form the crossmember blank (E).

4 Duplicate the half-pattern, and transfer the dado needed on each mating piece to form a mortise when the two pieces are joined. Using a miter gauge with a wooden extension for support, cut the dadoes in the mating pieces. Note that one edge is angled.



5 Glue the two ¾" crossmembers together, aligning the dadoes.

6 Transfer the outline of the crossmember shape to the laminated blank. Using a miter gauge with a wooden extension and a dado blade, cut the ends of the crossmember blank to form a tenon to fit snugly through the mortises in the uprights.

7 Bandsaw and sand the crossmember (E) to shape. Rout ½" round-overs on it where shown on the Crossmember drawing.

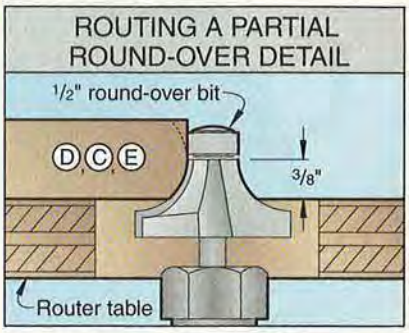
8 Transfer the shape, and bandsaw a pair of wedges (F) from ½" stock (we planed thicker stock).

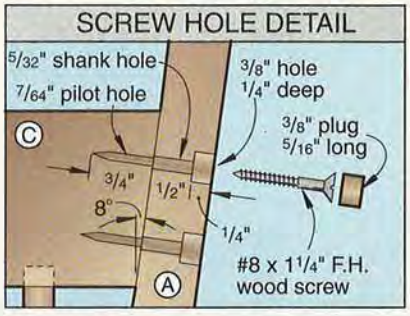
Final touches before gift wrapping

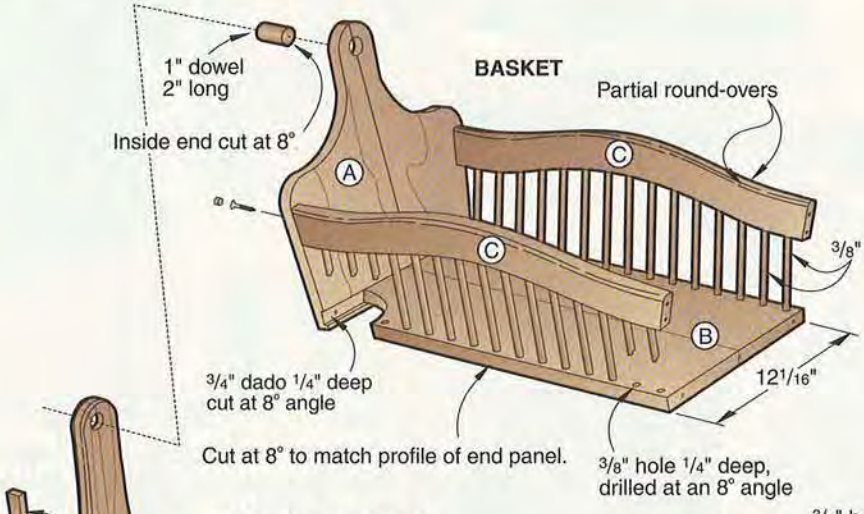
1 Finish-sand the basket, up-rights, crossmember, and wedges.

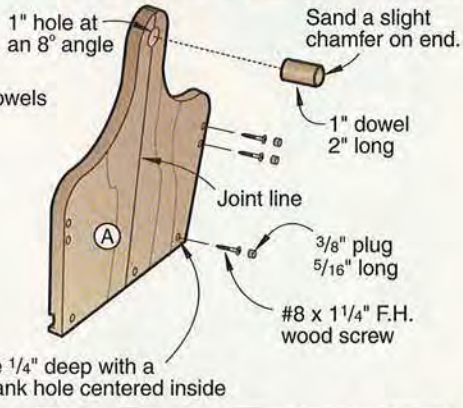
2 Stain, if desired (we left ours natural), and apply a clear finish.

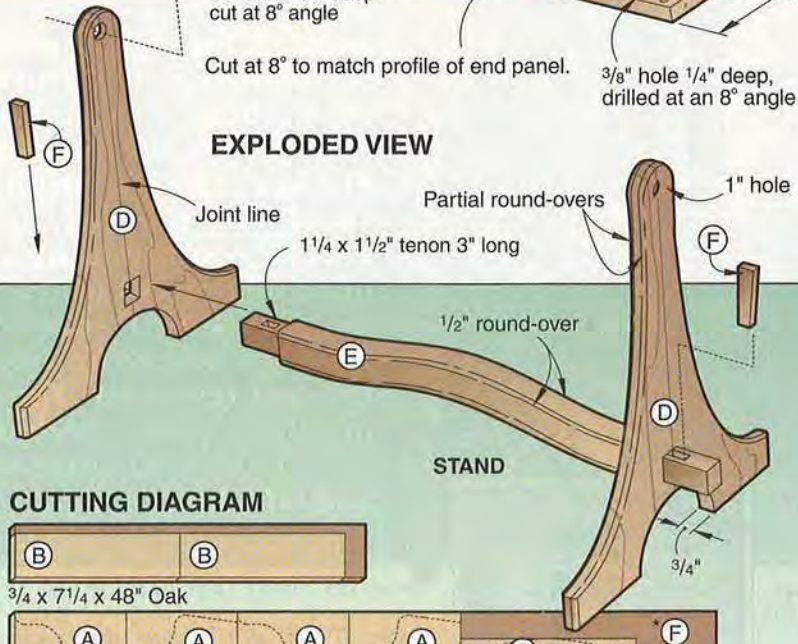
3 Position the basket and crossmember between the uprights. Tap the wedges through the mortises to stabilize the stand.











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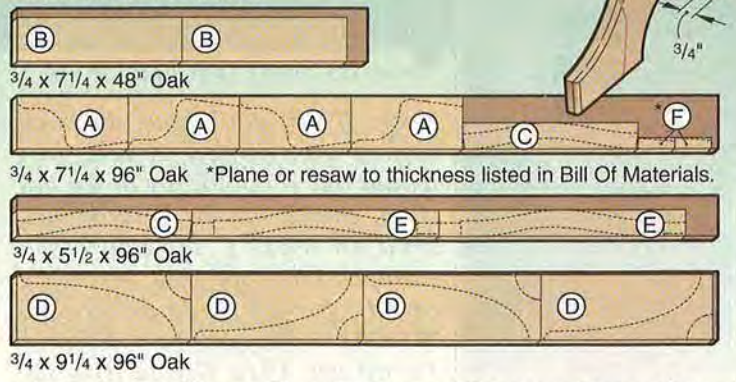
CUTTING DIAGRAM



Bill of Materials

Part	Finished Size T	W	L	Matl.	Qty.
A end-panel blanks	¾"	14½"	16"	EO	2
B bottom	¾"	12 1/16"	22 9/16"	EO	1
C top-rail blanks	¾"	3⅝"	24"	O	2
D upright blanks	¾"	18"	24"	EO	2
E crossmember blank	1½"	3⅝"	33¾"	LO	1
F wedges	½"	1"	3½"	O	2

Materials Key: EO–edge-joined oak
O–oak, LO–laminated oak

Supplies: #8x1¼" flathead wood screws, ⅜" and 1" dowel stock, clear finish.

Buying Guide
Hardwood kit. All the individual pieces shown on the Cutting Diagram cut slightly oversized from the thickness listed in the Bill of Materials. Available in oak. W90, $94.95 ppd. Heritage Building Specialties, 205 North Cascade, Fergus Falls, MN 56537. Or call 800/524-4184 to order.

Project Design: Hugh Nahrgang Illustrations: Roxanne LeMoine; Lorna Johnson Photographs: John Hetherington

Simply stated SHAKER

An elegant addition to any bedroom

Looking for a great piece of bedroom furniture? How about a complete set? We've got 'em–the Shaker cherry night-stand shown *at left*, and a full complement of matching pieces featured in previous issues of *WOOD*® magazine over the past few years. These matching pieces include a bed, cheval mirror, and tall chest.

Cheval Mirror
January 1992
Issue no. 49

Tall Chest
October 1992
Issue no. 55

Bed
October 1993
Issue no. 64

Note: *If you don't have the back issues mentioned* at left, *but would like a photocopy of the tall chest, cheval mirror, and/or bed, send an 8½×11" self-addressed stamped envelope and $4/article or $10 for all three articles to* WOOD *Magazine's Shaker Furniture, 1912 Grand Avenue, Des Moines, IA 50309-3379.*

Print this article

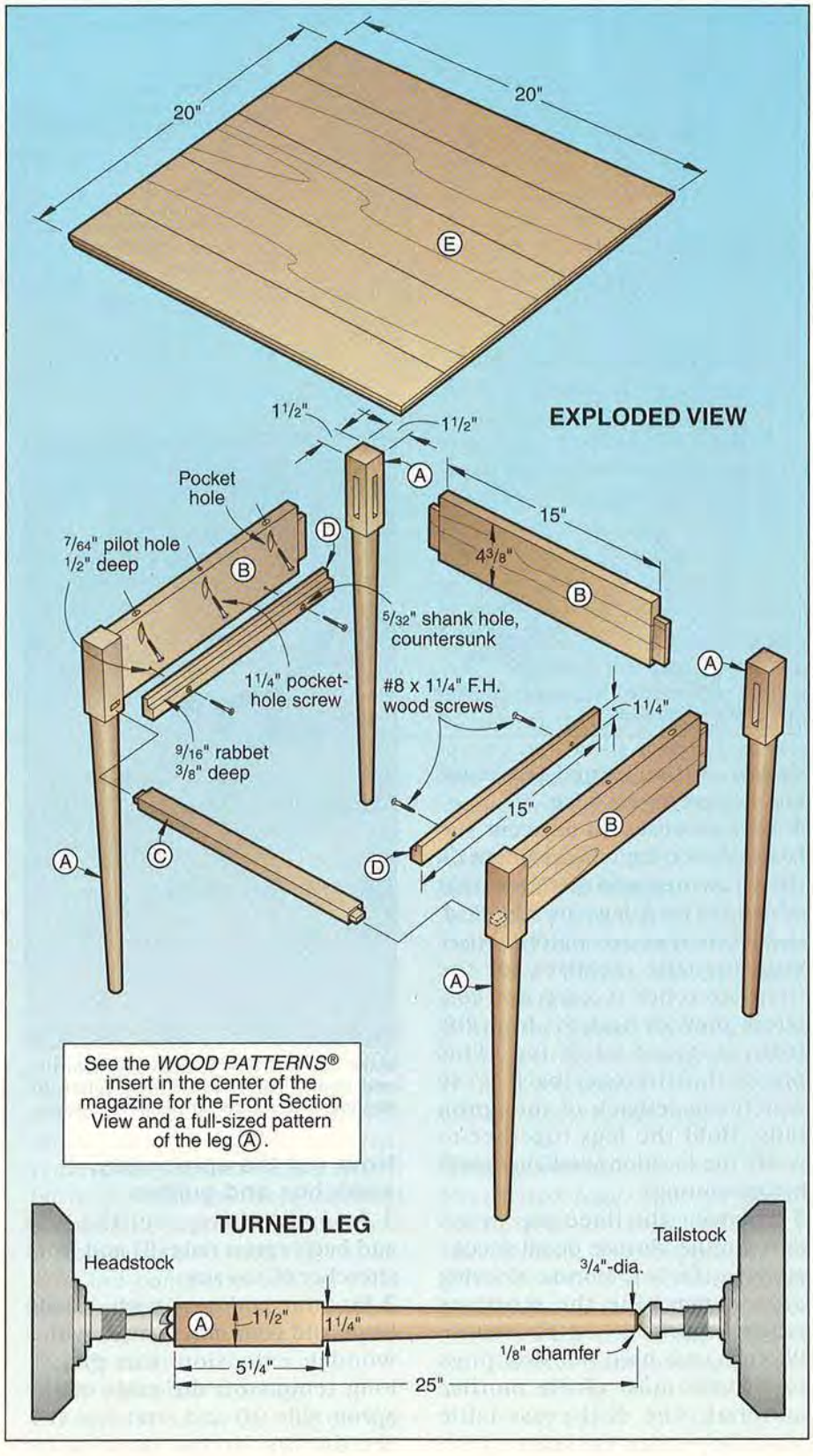
NIGHTSTAND

Bill of Materials					
Part	Finished Size			Matl.	Qty.
	T	W	L		
BASE					
A legs	1½"	1½"	25"	C	4
B aprons	¾"	4⅜"	16"	C	3
C stretcher	¾"	1⅛"	16"	C	1
D guides	¾"	1¼"	15"	C	2
E* top	¾"	20"	20"	EC	1
DRAWER					
F front	¾"	3½"	14⅞"	C	1
G sides	½"	3½"	16¼"	C	2
H back	½"	3"	14⅜"	C	1
I bottom	¼"	14⅜"	14¼"	P	1
J stop	½"	1⅜"	2"	C	1

*Initially cut parts marked with an *oversized. Then, trim to finished size according to the how-to instructions.

Materials Key: C–cherry, EC–edge-joined cherry, P–plywood

Supplies: 6–1¼" pocket-hole screws, 1" Shaker knob, #8×¾" roundhead wood screw, #6×¾" flathead wood screws, #8×1¼" flathead wood screws, finish.



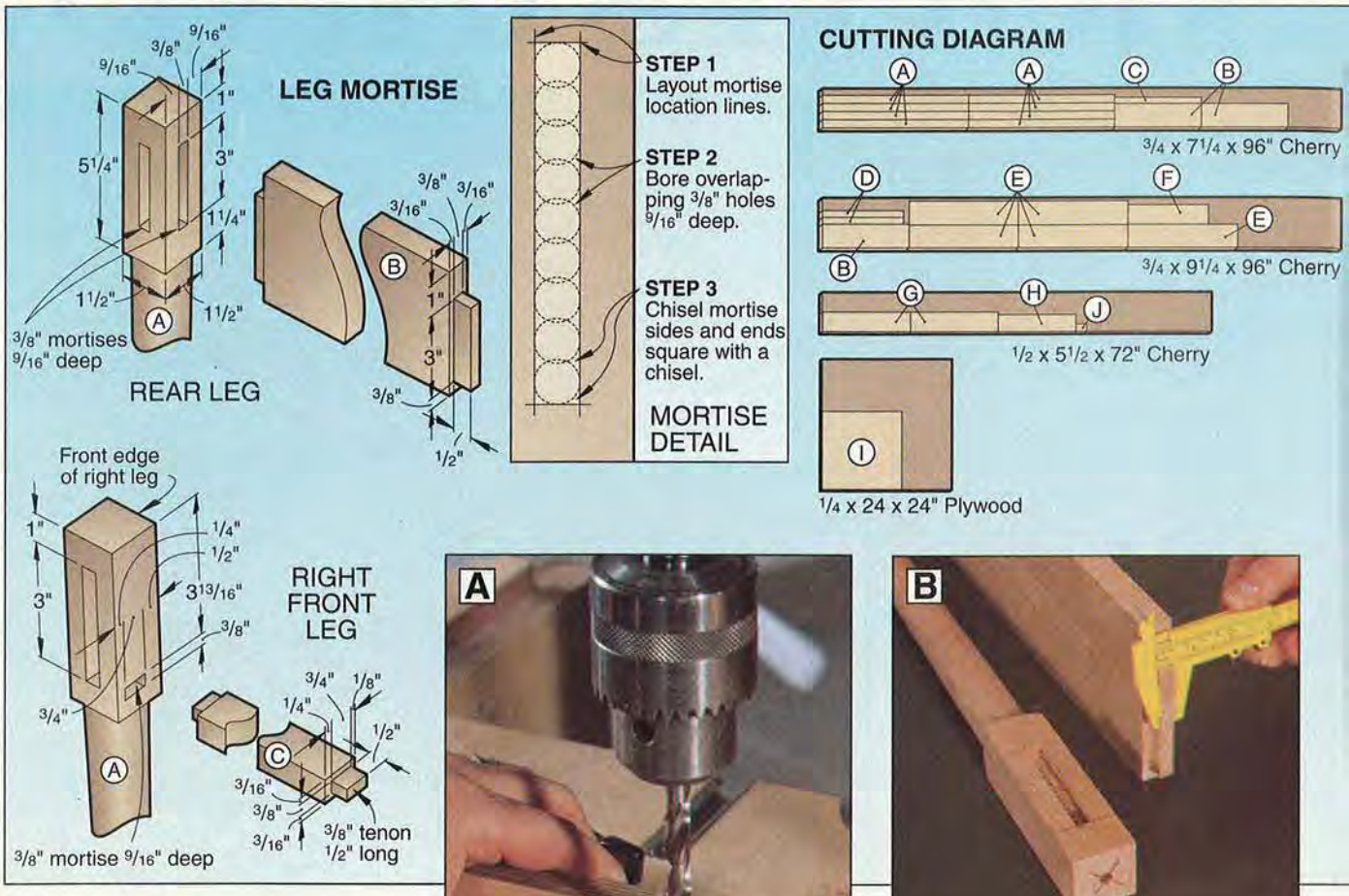
Start by turning the legs

1 To make the legs (A), you'll need four pieces of cherry 1½" square by 25" long. If you don't have stock this thick, you can laminate two pieces of ¾" stock, or see the Buying Guide for our source of turned legs. If you laminate stock, make the blank extra long, and then trim both ends for a 25" length. See the Turned Leg drawing for reference.

2 Mark diagonal lines on both ends of each leg to find the centers. Indent each centerpoint with an awl. For symmetrical legs, it's critical to carefully locate the centerpoints, and center the spur and cone centers on these centerpoints in the next step.

3 Mount a leg between centers on your lathe. Using a skew, turn the taper on the leg to the shape

Continued



shown on the Turned Leg drawing. Repeat for each leg.

4 Mark mortises on adjacent surfaces of each leg where shown on the drawings *above*. Note that while the back legs are identical, the front legs are paired. Also, note that the mortises for the front stretcher (C) are not centered; they sit back ½" from the front edge of each leg. This places the stretcher back ⅜" to match the setback of the apron rails. Hold the legs together to verify the locations and alignment before cutting.

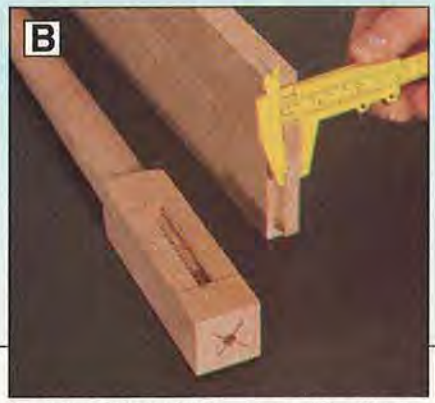
5 Following the three-step procedure on the Mortise detail accompanying the Leg Mortise drawing *above*, machine the mortises where marked. As shown in Photo A, we used our drill press to remove most of the mortise material. The drill-press table fence helps align the holes.

Mark the mortise locations carefully, and use a drill press with a fence for alignment to remove most of the stock.

Now, cut the apron rails, stretcher, and guides

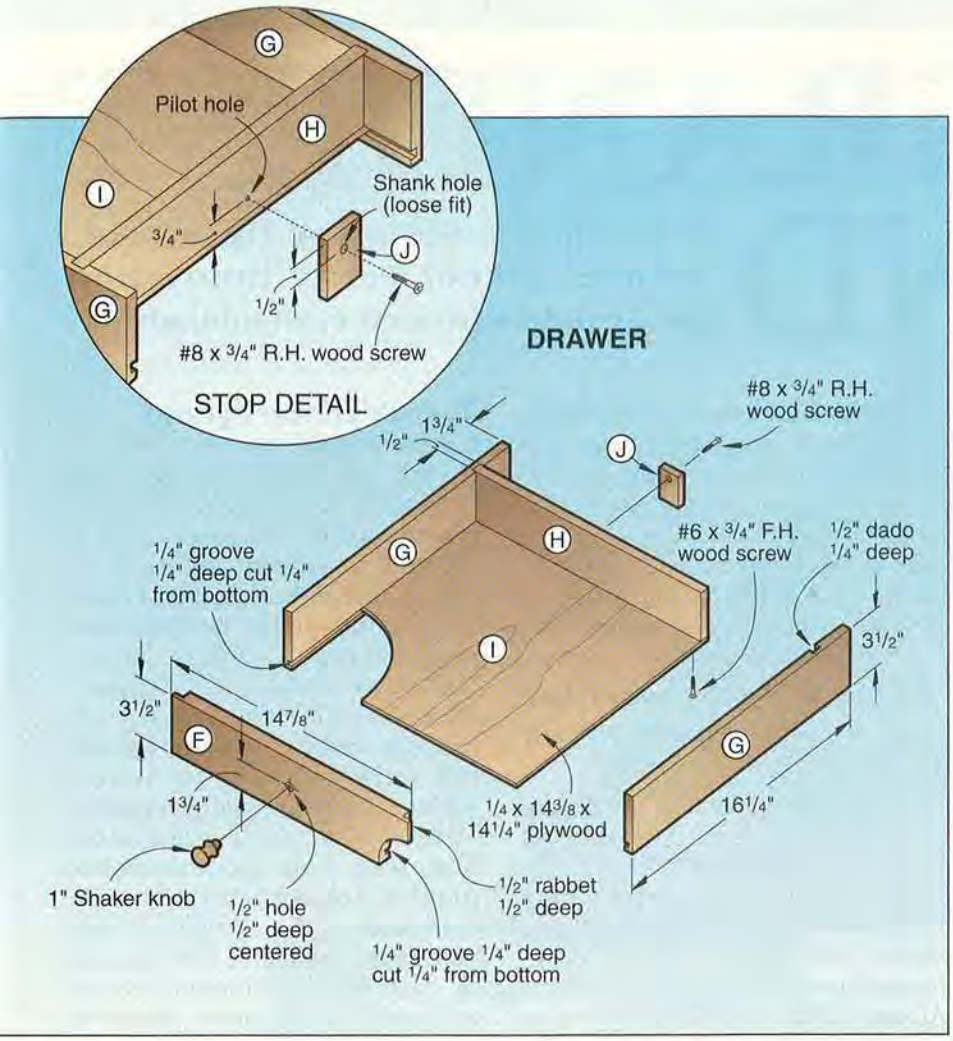
1 From ¾" cherry, cut the side and back apron rails (B) and front stretcher (C) to size.

2 Fit your tablesaw with a dado blade and your miter gauge with a wooden extension. Cut the ½"-long tenons on the ends of the apron rails (B) and stretcher (C). See the Leg Mortise drawing for



For snug-fitting joints we used a vernier calipers to measure the leg mortises and mating tenons on the aprons.

reference. See Photo B for our method of measuring the thickness with a vernier calipers. For further information on this useful tool, see the article on *page xx*. (We cut scrap stock first to verify the fit of the tenons into the mortises in the legs. When checking the fit of tenons in mortises, we wrapped a piece of paper around the tenon, and then slipped the tenon into the mortise. The paper ensures that you have enough room for glue coverage for a strong joint. An extremely tight fit can force the glue off the mating surfaces when fitting the pieces together and result in a weak, glue-starved joint.) Glue and clamp the base (A–C) together, checking for square.



3 Cut the drawer guides (D) to size. Now, cut or rout a 9/16" rabbet 3/8" deep along the top inside edge of each. See the Front Section View drawing on the insert. Keeping the bottom edge of the guides flush with the bottom edge of the apron rails, drill a pair of mounting holes in each guide, and screw them to the inside face of the apron rails where shown on the Front Section View drawing.

The tabletop comes next

1 Edge-join enough 3/4"-thick stock to form a blank measuring 21" square for the tabletop (E). (We used five 4 1/4"-wide pieces to form the top.) Pay close attention when clamping the pieces together that the lamination stays flat.

2 Remove the clamps, scrape off the excess glue, and trim the edge-joined top (E) to finished size (20" square).

3 Rout a 1/2" chamfer along the bottom edge of the tabletop where shown on the Front Section View drawing. (To minimize chip-out, we routed ours in several passes, increasing the depth of cut each pass.)

4 Turn the tabletop and base upside down, and center the assembled base on the bottom of the tabletop. Using a pocket-hole jig, drill the mounting holes, and screw the base to the top. To allow for wood movement, remove the jig and rock the drill bit in the hole to create a slotted shank hole. This allows the screw to move slightly with the expansion and contraction of the solid-wood tabletop.

The drawer adds valuable storage

1 From 3/4" stock, cut the drawer front (F) to size. Then, from 1/2" stock, cut the drawer sides (G) and back (H) to size.

2 Using the dimensions on the Drawer drawing, cut the rabbets and grooves in the drawer front and sides.

3 Drill a hole centered in the drawer front for the Shaker knob. Test-drill a hole in scrap stock to verify the necessary size for your particular knob.

4 From 1/4" plywood, cut the drawer bottom (I) to size. Dry-clamp (no glue) the drawer together to check the fit of all the pieces. Remove the clamps, and check its fit into the opening. Then, glue and clamp the drawer (F-I) together, checking for square.

5 Cut the drawer stop (J). Drill the mounting hole for connecting it to the back of the drawer. Slide the drawer into the base, and then add the stop to the back of the drawer. See the Stop detail accompanying the Drawer drawing *at left*. Don't drive the mounting screw too tight. Allow the stop to rotate on the screw so it can be swung out of the way to clear the front stretcher for removing the drawer from the base.

Clean it up, and add the finish

1 Remove the top (E) from the base and remove the drawer from the base. Finish-sand the base, top, and drawer.

2 Add the finish. (We used satin Minwax fast-drying polyurethane.) Reconnect the top, and add the knob to the drawer.

Buying Guide

Preturned legs. Four 1 1/2"-square cherry legs 25" long and one 1" cherry knob, $39.95 ppd., kit no. SHLEGS. Add $54.95 for enough cherry stock (cut slightly oversized) for the rest of the table, kit no. SHTBL. Schlabaugh & Sons Woodworking, 720 14th Street, Kalona, IA 52247, or call 800/346-9663 to order.

Written by Marlen Kemmet Project Design: James R. Downing Illustrations: Roxanne LeMoine; Jamie Downing Photographs: Wm. Hopkins

AN UP-CLOSE LOOK AT

THE GRANDEST GRAND

What makes Steinway the world's premier piano? Partly innovation, partly old-fashioned craftsmanship.

In a 1988 cover story, "What America Makes Best," *Fortune* magazine listed the pianos of New York's Steinway and Sons along with the crystal of Steuben Glass, Boeing's 747 jet aircraft, and the earthmoving equipment of Caterpillar. These and 96 other made-in-the-U.S.A. products were selected as the finest of their kind in the world based on innovation, technological advancement, durability, and value. So, at a price of around $75,000 for a new concert grand, we wondered just what a customer pays for when he or she buys a Steinway.

At Steinway, it's always been quality over quantity

The New York factory of Steinway and Sons produces about 3,400 pianos annually, a rate that hasn't varied much in their 143 years of doing business. Today, that's less than 2 percent of the U.S. market. In comparison, Yamaha makes 250,000 pianos a year. Yet, Steinway pianos represent more than 20 percent of all the grand pianos sold, and over 35 percent of grands longer than 6' 1". And the company takes great pride in the fact that more than 90 percent of all piano concerts at major musical events throughout the world are performed on a Steinway. The reason for this incredible appreciation unfolds in the company's history.

The company that just kept on growing

Heinrich Engelhard Steinweg came to New York City from Germany with his family in 1850. A fine craftsman in his hometown of Seesen, he had operated a modest piano-and-instrument-building shop. But he could foresee economic problems coming in the fatherland and sought to better himself in America.

Not long after his arrival, Heinrich anglicized his name to Henry E. Steinway and, along with three of his sons, began working for New York's major piano maker at that time. Three years later, Henry Sr., sons Henry Jr., Albert, Charles, and William (who had been employed by a competing New York piano firm during the same period) founded Steinway and Sons in a small building in lower Manhattan.

"To put it simply, either one buys a piano or one buys a Steinway."

—Author Larry Fine, writing in *The Piano Book*

Less than a decade went by before the remarkably successful Steinways had built a new factory—then the largest for pianos anywhere in the world—and established their product as a symbol of unparalled excellence. This was mainly due to the Steinways' development of a new-sounding piano. By combining a soundboard that overlapped bass and treble strings with a cast-iron plate frame, their overstrung grand piano provided more volume and a powerful bass without a detracting metallic sound. The cases of their pianos also were exceptionally executed, sometimes inlaid with mother-of-pearl—the work of proud and experienced master craftsmen trained in the old-world tradition.

Today's concert grand takes shape

By the late 1800s, though, concert halls were growing larger and European composers such as Brahms were developing more technically challenging music. These combined to demand more powerful pianos.

How to achieve it? Because a piano's volume and resonance is proportional to its string tension, the only way was to build a stronger case and plate assembly.

By 1876, C. F. Theodore Steinway, an accomplished pianist, tonal technician, and then head of the company's manufacturing, had met this demand by creating the Centennial Grand. It featured a one-piece piano rim (shown in drawing *right*) made up of 18 maple laminations bent around in a shape that is now standard for concert pianos. Prior to this, manufacturers made grand pianos rectangular.

The stronger rim of the Centennial Grand allowed 70,000 pounds per square inch of string tension, thus greater volume and resonance. (Combined with other tonal improvements, today's grands require only about 35,000 pounds per square inch.) From that time, Steinway grands—each taking a year to create—became the instrument against which all other pianos were judged.

Would you like to tour the factory?

Free public tours of the Steinway factory in Queens, New York, are given most Friday mornings throughout the year by appointment only. Call 718/721-2600, ext. 3116.

Steinway's Craftsmanship

The Model D Concert Grand below, in East Indian rosewood, costs over $72,000, measures 8' 11" long, has more than 12,000 parts, and takes about 250 people assigned to different tasks one year to make.

It takes 15 to 20 quartersawn yellow poplar boards, edge-joined, to form the piano top. The last board on the bass side is maple, to hold the hinges. When completed, the top is covered by veneer.

A 22'-long continuous grand-piano rim consists of 18 3/16"-thick laminations of flatsawn hard maple bent as a single unit to provide the solid foundation for interior parts.

The pinblock consists of seven hard-maple laminations set at 45° and 90° to each other so the tuning pins are gripped by end grain around their circumference.

Most piano manufacturers purchase actions from suppliers. Steinway carefully crafts its own of hard maple, felt, leather, spring wire, and small bits of metal.

For the soundboard, Steinway selects vertical-grain Sitka spruce with no fewer than 10 growth rings per inch. For unified vibration, the soundboard tapers from a thickness of 8mm at the center to 5mm at the edge.

Traditional black concert pianos get five coats of sprayed-on black lacquer cured over five weeks, with sanding between each application. Natural-finished pianos receive the same amount of clear lacquer.

Written by Peter J. Stephano Drawings: Brian Jenson Photograph: Courtesy of Steinway and Sons

Random-Orbit Sanders

The one sanding tool no woodworker should be without

With a random-orbit sander you have the best of both worlds: They sand aggressively *and* smoothly. No other portable sander can make that claim, so it's no wonder that these tools have taken woodworkers by storm recently. Here we tell you how they work, what features to look for, and which models perform best for us.

The advantages of a random-orbit sander

To give you the fast and aggressive stock removal of a disc sander, and the controllable smoothness of a finishing sander, a random-orbit sander combines the pad motions of both machines. Like a finishing sander, an r.o. sander has an offset-bearing mechanism joining the drive shaft to the pad. This mechanism causes the pad to move in tiny orbits ranging from 5/64" to 9/32" in diameter. But, unlike a finishing sander, the round pad of a random-orbit sander is free to rotate. To picture the pad motion this creates, imagine a finishing sander that, while running, is also spinning completely around several hundred times per minute.

So what's the result of this dual motion? A random-orbit sander removes stock much faster than a finishing sander because of its rotational movement. And, because of this rotation, each orbiting abrasive grit moves in an increasingly larger sweep toward the outside of the pad. These sweeping scratches overlap each other in a random fashion that's harder to detect than the telltale swirls left by a finishing sander.

In our shop, we use a random-orbit sander for many sanding tasks formerly done by our belt sander, and ¼- and ½-sheet finishing sanders. Exceptions are the times when we need the square pad edges of a ¼-sheet finishing sander to reach into corners and along edges. We also favor a ¼-sheet sander for sanding with 220-320-grit abrasives, when control counts more than speed. And, we like the soft pad of a palm sander for gently contouring rounded surfaces, and other tasks that require its soft pad.

Although we still prefer a belt sander for quickly flattening edge-joined boards, we reach for a random-orbit sander when we need to flatten face- and door-frame joints. That's because an r.o. sander leaves minimal scratches regardless of grain direction, and gives greater control over stock removal than a belt sander.

If you're about to buy your first portable sander, a random-orbit sander will prove most versatile. Next on your list should be a belt sander, followed by a ¼-sheet sander, and a detail sander.

We tested two types of random-orbit sanders

For this article we focused our testing on electric-powered random-orbit sanders with motors that stand vertically when you rest the tool on its pad. These sanders come in two types—palm-grip and side-handle. Both have proved popular with woodworkers for two reasons. First, they don't require a compressor (we'll tell you about air-powered versions later). And, they are easy to control because the motor weight centers over the sanding pad.

Palm-grip type

Palm-grip types have small housings that you grip with one hand. This frees your other hand to steady the workpiece or yourself. You'll find these lightweight models best suited for finish sanding with finer grits. They're also useful for flattening joints that are misaligned by up to 1/32". And, they're inexpensive, costing $40–$100.

Side-handle types have a 4–6" handle that extends 90° from the motor housing, and typically have a knob on the opposite side of the housing for two-handed control. Several models also have motor-housing tops shaped for one-handed holding on horizontal surfaces.

The side-handle models priced under $100 sand about as aggressively as the palm-grip types. The models over $100 remove stock much more quickly. Despite this aggressiveness, the best side-handle machines sanded with as much finesse as the smaller sanders, or more, because of their well-balanced components.

Side-handle type

Other r.o. sanders you should know about

If you're especially looking for aggressive stock removal, or have access to a powerful compressor, you may be interested in a grinder-based or an air-powered random-orbit sander. Here's a quick look at each:

•Grinder-based models. These were the first electric r.o. sanders to hit the U.S. market about five years ago. They're easy to make because manufacturers simply add a random-orbit sanding head to an existing grinder motor.

The DeWalt DW443 is a typical grinder-based random-orbit sander.

These aggressive machines work great for hogging away lots of wood, removing paint and other tough finishes, or smoothing tough materials such as fiberglass. For general-purpose woodworking, however, we find them tippy and too hard to control. They sell for $140 and up.

•Air-powered models. Long before electric-powered random-orbit sanders arrived on the scene, air-powered random-orbit (or dual-action) sanders were used extensively in professional woodworking and autobody shops. Even today, an air-powered sander is still your best option *if* you have a compressor with at least a 5-hp motor and 30-gallon tank.

You can expect a pneumatic sander to be more powerful, durable, and easy to control than a similarly priced electric machine. Like electric models, pneumatic machines come in palm-grip and side-handle versions, as shown by the two National-Detroit models *below.*

Like electric random-orbit sanders, you can buy air-powered models in palm-grip and side-handle configurations.

Note: *We've had good luck with the DeWalt and National-Detroit models shown here. But, within the confines of this article we could not test all grinder-based or air-powered sanders.*

Finish quality: some sanders were smoother operators

Several factors contribute to the finish quality that you get from a random-orbit sander. First and foremost, a random-orbit sander should leave a hard-to-detect *scratch pattern*. To test for this, we outfitted all of the sanders with 80-grit abrasive and placed them on a sheet of acrylic for 3 seconds. Our test yielded scratch patterns from which we assigned grades for the chart at the end of this article. The photo at the *top of the next page* shows you the best and worst of what we observed.

In the chart, we make note of four other performance areas that affect finish quality: *control, vibration, pad brake,* and *pad speed*. Here's a look at each:

•Control. Because of the rapid rotations and orbits of their pads, some r.o. sanders wobble and shake slightly. These tendencies

Continued

Random-Orbit Sanders

can affect finish quality in two ways. First, they make it harder for you to guide the sander. And, they may cause the machine to skip or bounce on the surface.

To minimize wobble and shake, the pad-drive mechanism must be well balanced. Several machines rated "excellent" in control, but the Bosch 3725DVS and 3727DVS were tops. This might be because they were the only tested models with *two* offset bearings that support the drive shaft.

- **Vibration.** The Metabo 0125 and Porter-Cable 333 had the least vibration of the tested models. Vibration, too, can make a sander hard to control. It can also leave your hand tingling and have a negative effect on tool longevity.
- **Pad brakes.** When electric random-orbit sanders first hit the market, none of them had pad brakes. Now, all but seven of the 18 tested machines have brakes.

This simple mechanism typically consists of a rubber ring that presses against the pad as shown on the Bosch 3725DVS *near right*. The unique Porter-Cable brake consists of a rubber belt that wraps around the pad mount and idler pulley as shown *far right*.

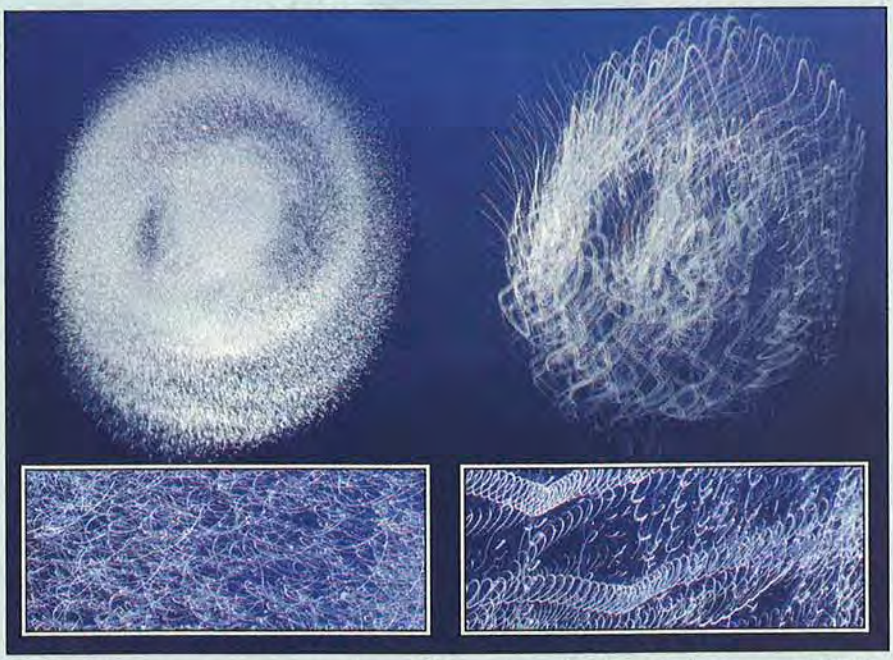
These brakes have a big effect on finish quality because they prevent the pad from developing a high rotational speed when you momentarily lift it off a surface. This helps prevent accidental gouging when you return the sander to the surface.

- **Pad speed.** Note in the chart under "top pad speed (orbits per minute)" that about half of the units operate at a fixed high speed, and the others operate within a variable-speed range. By slowing the speed, you will reduce your chances of accidentally removing too much material during delicate tasks. Examples include sanding veneer, smoothing a coat of finish, or rounding over an edge.
- **Operator.** No, we don't rate this in the chart, but finish quality

The Bosch 3725DVS left hard-to-detect scratches (right). Most low-cost models leave detectable scratches such as those produced by the Sears 27717 (left).

The pad brake on the Bosch 3725DVS consists of a rubber ring that contacts the underside of the sanding pad (pad removed for clarity).

The Porter-Cable 333's pad-brake mechanism has a rubber belt wrapped around the pad mount and idler pulley (sanding pad removed for clarity).



Putting heavy pressure on a random-orbit sander will change it from a smooth performer (left) to one that leaves easily detectable scratches.

also depends on your handling of the sander. Of course you should keep all sanders flat on a surface and moving during use. *But, with a random-orbit sander, it's especially important that you not apply too much pressure.* Although additional pressure will help the machine remove more stock up to a point, too much pressure will slow the rotations of the pad. As rotations slow, the machine works more like an orbital-only (finishing) sander.

The photos *opposite page, bottom,* show the normal sanding pattern of the Makita BO5001, and what happened when we applied enough pressure to slow the pad markedly. As you can see by the closeup photos, the random pattern was replaced by telltale rows of swirly marks. Because it's working like an orbital sander, an r.o. sander under this much pressure actually cuts *slower* than if there was no pressure on it.

A machine that's quite a bit different

With the Black & Decker RO600 you can remove its round pad (that rotates) and substitute in its place a bullet-shaped pad for orbital sanding only (it doesn't rotate). The orbital-only pad has a point so that you can reach into tight corners and between shutter louvers, just as you would with a detail sander.

The Black & Decker RO600 doubles as a finishing/detail sander when outfitted with its bullet-shaped pad.

Aggressiveness: these sanders really make the cut

If fast sanding matters to you, look for a model that draws more than 2 amps of power. You can exert more pressure on these machines before the pad rotations slow down noticeably.

Also, keep in mind that machines with larger orbits cut faster. Not coincidentally, the machine with the largest orbit, the CP Electric TXE150 with a 3/32" orbit, was also the most aggressive sander in the test. Another reason this machine sands aggressively is that it's the only tested unit with a gearbox between the motor and the random-orbit mechanism. The gears reduce the pad speed by a 4-to-1 ratio, so the motor runs at about 40,000 rpm while the pad orbits at about 10,000 opm. This high motor speed gives the TXE150 more torque than the other units, along with two other benefits. The motor-cooling fan and dust-collection fan run at the motor's speed, so this tool stays cool, and has the most-effective dust collection of the tested sanders.

***Note:** As this article goes to press, the CP Electric brand is being phased out of the market. Certain CP Electric models, including the TXE150, will be available under the Milwaukee brand. The TXE150 will now have a red housing and will be a Milwaukee model 6025-6. Milwaukee also will market a 5" version of this tool without variable speed as model 6020-6.*

Dust collection: Use a shop vacuum for best results

Random-orbit sanders spew out lots of fine dust that quickly fills the air of your shop, so we consider dust collection an especially important consideration. All of the tested machines—with the exception of the Makita BO5001, Ryobi RS112, and Sears Craftsman 27714—have a fan that draws dust through holes in the pad, and some means of storing the dust. (The Makita BO5001 has no fan or dust container, but does have a vacuum port.) Of the machines with an on-tool dust-collection system, only the Sears Craftsman and Ryobi models cannot be hooked to shop vacuums.

The model with the best on-tool dust-collection system is the CP Electric. Because of its high fan speed, it is the only machine that collected dust efficiently at low pad speeds. At high speed it captured about 95 percent of the dust before it became airborne. The other sanders had to be hooked to a shop vacuum to attain this level of collection.

The machines with the next-best on-tool dust collection—the Bosch 3725DVS and 3727DVS—collected about 80 percent of the dust when not hooked to a vacuum. Also affecting each machine's dust-collection rating was the amount of fine dust leaking through and around its dust container.

Because of their small dust ports, all of the vacuum-ready machines, except the Black & Decker RO100, require the manufacturer's special hose and/or adaptor. The RO100 connects to standard 1¼" and 1½" hoses.

Although a manufacturer's hose will cost you extra, you may find it worth the expense. We've used the Bosch 1" hose and find it much lighter and more flexible than a standard 1¼" or 1½" hose. It costs about $20.

Continued

Random-Orbit Sanders

More points to consider

•**Pads.** For most woodworkers, a machine with a 5" pad will handle almost all tasks. You may prefer a machine with a 6" pad if you frequently use it on large glue-ups.

No matter what size you select, check to make sure the pad is relatively flat. Although some pads are designed to be just slightly lower in their centers, we came across a few pads that were severely warped. You can identify this problem easily because the abrasive will cut only on the outside edge of the pad.

Each year, more r.o. sanders come standard with pads compatible with hook-and-loop (H&L) abrasives. H&L discs cost more than pressure-sensitive adhesive (PSA) discs, but you can effortlessly change H&L discs and reuse them. If you change grits frequently, and generally don't wear out a disc before switching to another, H&L discs more than pay for themselves. Also, you may find PSA discs hard to remove, and they may even leave a sticky residue on a workpiece should they tear in use.

All of the sanders that we tested, with the exception of both Sears Craftsman models and the Ryobi RS200, come standard with H&L pads. You can buy most of the tested models with standard PSA pads, too. And, for most models you can buy either H&L or PSA pads as optional items.

•**Noise.** Noise levels did not vary much among the machines, but the noise *quality* did. The CP Electric has the most irritating noise because of its gearbox.

•**Cords.** Our tested machines had cords ranging from 6' to 10' in length. The longer cords were less apt to get caught on the edges of large workpieces, and sometimes they saved us from having to run for an extension cord. The cords with rubber covers were more flexible than the plastic ones, especially in cooler temperatures.

•**Weight.** If your work requires that you frequently use an r.o. sander on vertical surfaces, pay close attention to the "weight" column in the chart. The heaviest models weigh twice as much as the lightest ones.

Our recommendations

For all-around usefulness, we favor the more powerful side-handle sanders. But, you might prefer a palm-grip sander if you do small woodworking projects for the most part.

Among the **side-handle** sanders, the Bosch 3725DVS and 3727DVS get our nod as the top tools. They're smooth, powerful, and a breeze to maintain.

We also liked the CP Electric TXE150/Milwaukee 6025-6 for its aggressive sanding and superb dust collection. However, it's the only machine with 16-hole paper. You can buy these discs at Milwaukee dealers, or through mail-order catalogs, but they're not widely available so far.

The top-value machines in this class are the Bosch B7255, Skil 7435, and Black & Decker RO600. The Bosch B7255 or Skil 7435 won't disappoint the occasional woodworker. Because of its versatility, the Black & Decker RO600 nicely meets the needs of the beginning woodworker who wants to buy only one sander.

In the **palm-grip** class, the Porter-Cable 333 earns both our top-tool and top-value designations. It was the smoothest and most comfortable tool to hold among the palm-grip sanders. It doesn't have variable speed, but we didn't miss this feature when using the less aggressive palm-grip machines.

Another top value among the palm-grip machines is the new Black & Decker RO100. It won't hold up to heavy use as well as the P-C, but its performance isn't far behind.

PALM-GRIP SANDERS

SIDE-HANDLE SANDERS

6" SIDE-HANDLE SANDERS

HOW TODAY'S RANDOM-ORBIT SANDERS STACK UP

TYPE	PAD SIZE (INCHES)	BRAND	MODEL (1)	AMPERAGE DRAW	TOP PAD SPEED (ORBITS PER MINUTE)	ORBIT DIAMETER (INCH)	SWITCH TYPE (2)	DUST-COLLECTION TYPE (3)	PERFORMANCE (4): DUST-COLLECTION EFFICIENCY (5)	AGGRESSIVENESS	SANDING PATTERN	CONTROL	PAD BRAKE	VIBRATION	NOISE	CORD: COVER TYPE (6)	CORD: LENGTH (FEET)	OPTIONAL ACCESSORIES (7)	WARRANTY (YEARS)	COUNTRY OF ASSEMBLY (8)	WEIGHT (POUNDS)	SELLING PRICE (9)	COMMENTS
PALM-GRIP	4½	RYOBI	RS112	2	11,000	5/32	SR	NONE	N/A	G	F	G	NONE	G	E	P	6	BP, SP	2	U	2.6	$ 45	Smaller pad is well suited for tight quarters and small projects, but 4½" sanding discs are harder to find than 5" abrasives.
		SEARS CRAFTSMAN	27714	2	11,000	5/32	SR	NONE	N/A	G	F	G	NONE	G	E	R	10		1	U	2.8	40	Same machine as Ryobi RS112, but has PSA pad. Its 10' cord proved handy.
	5	BLACK & DECKER	RO100	2	12,000	3/32	SR	C	G	E	G	E	E	G	G	P	6	BP, SP	2	U	3.1	40	Well-designed and constructed machine for its price. Has dust port that fits standard vacuum hose.
		DEWALT	DW423	2	7,000-12,000	3/32	SR	PF	F	G	G	G	G	F	G	R	8	VA	1	U	3.3	100	New variable-speed version of the DW421. A good performer, but dust-containment system proved leaky.
		MAKITA	BO5001	1.7	10,000	5/32	R	VAC ONLY	N/A	G	G	G	NONE	G	E	P	7	VH	1	J	2.9	70	Lack of pad brake and on-tool dust-collection system holds back this otherwise good performer.
		PORTER-CABLE	333	1.7	12,000	3/32	R	PF	G	F	E	G	E	G	E	R	7	BP, VH	1	U	3.5	80	A quiet sander with excellent pad brake. It was the top palm-grip sander, but high fixed speed limits the machine's finesse.
SIDE-HANDLE	4½	RYOBI	RS115	2	0-11,000	5/32	VST	PC	F	F	G	G	NONE	G	G	R	6	BP,CC, SP	2	U	3.3	75	Similar in performance to the Ryobi RS112, but has side handle and dust collection.
	5	BLACK & DECKER	RO600	1.4	10,500	5/64	SPB	C	G	G	F	G	F	G	G	P	6	BP, SP, VA, XT	2	E	3.2	60	Unique machine that can also serve as finishing sander and detail sander.
		BOSCH	B7255*	3.3	4,500-13,000	3/16	T	C, P	G	G	G	F	G	F	G	R	8	BP, CC, HP, MD, MF, MP, PD, SO, SP, VA, VH	1	S	5.4	110	A solid, middle-of-the-road machine perched between the least- and most-expensive units.
			3725DVS	3.3	4,500-12,000	3/16	T	C, P	E	E	E	E	G	G	G	R	10	BP, CC, HP, MD, MF, MP, PD, SO, SP, VA, VH	1	S	5	150	Our favorite machine for all-around performance. Its optional paper bags contain nearly all dust.
		HITACHI	FSV13V	2.5	6,500-11,000	3/16	T	C	G	G	E	F	NONE	F	F	R	8	BP, DS, VA	1	M	4.6	90	Performs almost as well as the top Bosch and CP Electric models, but was a little harder to control.
		METABO	0125	2	5,000-12,000	7/32	VST	C	F	G	E	E	NONE	E	F	R	8	BP, CC, PD, SO, SP	1	G	5.1	160	A top-performing machine that would be better with the addition of a pad brake.
		RYOBI	RS200	3	13,000	5/32	T	PC	F	F	P	G	G	F	F	R	10	BP, CC, SP	2	U	3.6	80	Same as Sears Craftsman 27717.
		SEARS CRAFTSMAN	27717	3	13,000	5/32	T	PC	F	F	P	G	G	F	F	R	10	HL	1	U	3.6	70	Fixed-speed sander with PSA pad. Has good power and long cord.
		SKIL	7435	2.8	7,000-12,000	3/16	T	C	F	G	E	G	G	F	F	P	8	BP, CC, HP, MD, MF, MP, SP	2	H	4.4	65	Doesn't have a lot of power, and vibrates some, but its low price makes it a top value among side-handle models.
		WEN	18	2	0-12,000	5/32	T	PF	F	G	G	G	NONE	F	G	P	6		2	U	3	60	Good performance for the price. A small amount of play in the pad bearing may affect longevity.
	6	BOSCH	3727DVS	3.3	4,500-12,000	5/32	T	C, P	E	E	E	E	G	G	G	R	10	BP, CC, HP, MD, MF, MP, PD, SO, SP, VA, VH	1	S	5.1	155	Similar to the Bosch 3725DVS, but with a 6" pad.
		CP ELECTRIC/ MILWAUKEE	TXE150 / 6025-6**	3.5	8,000-11,000	9/32	VST	C	E	E	E	E	E	G	F	R	10	BP, PD	1	G	5.9	145	The most aggressive machine in test. Also has the best on-tool dust-collection system. Optional paper bags contain nearly all dust.

NOTES:

1. * Also available as Bosch model 3107DVS.
   ** See "Note" in article.
2. (R) Rocker
   (SPB) Sealed push button
   (SR) Sealed rocker
   (T) Trigger
   (VST) Variable-speed trigger
3. (C) Cloth bag
   (P) Paper bag
   (PC) Plastic cage with porous membrane
   (PF) Porous foam-plastic canister
4. E Excellent
   G Good
   F Fair
   P Poor
5. Without vacuum
   (N/A) Not applicable
6. (P) Plastic
   (R) Rubber
7. (BP) Buffing pad
   (CC) Carrying case
   (DS) Dust shroud
   (HL) Hook & loop pads
   (HP) Hard pad
   (MD) Mesh discs
   (MF) Micro-finishing discs
   (MP) Medium pad
   (PD) Paper dust bags
   (SO) Soft pad
   (SP) Sponge pad
   (VA) Vacuum adaptor
   (VH) Vacuum hose
   (XT) Extra tips
8. (E) England
   (G) Germany
   (H) Holland
   (J) Japan
   (M) Malaysia
   (S) Switzerland
   (U) United States
9. At time of article's production.

MANUFACTURERS:

Black & Decker 800/762-6672

Bosch 312/286-7330

CP Electric/ Milwaukee 800/243-0870

DeWalt 800/433-9258

Hitachi 800/362-7297

Makita 800/462-5482

Metabo 800/638-2264

Porter-Cable 800/487-8665

Ryobi 800/525-2579

Sears Craftsman Call or visit your local Sears store.

Skil 312/286-7330

Wen 800/462-3630

Written by Bill Krier Technical consultant: Dave Henderson Photographs: William Hopkins; John Hetherington

WATCHMAKING ON

The watch measures 15" long when hanging, as shown *right.*

Some guys flash around big, fancy wristwatches as status symbols. Now, you can, too! And you'll be extra proud of this really BIG watch because you made it yourself.

Start with the watchcase

1 Photocopy the full-sized patterns for the watch parts in the *WOOD PATTERNS*® insert in the middle of the magazine.

2 Using spray adhesive or rubber cement, adhere the pattern for the watch (A) to one face of a ¾×3⅜×4½" piece of stock. (We used oak.)

3 Transfer the centerlines for the holes through the watch lugs to the edges of the blank. Mark a center on each line ¼" from the bottom of the blank. Chuck a 17/64" bit in your drill press, and drill about 1" deep at each center.

4 Transfer the stem hole centerline to the adjacent edge. Mark a center ⅜" from the bottom on that line, and drill a 17/64" hole ½" deep.

5 Change to a 2⅜" Forstner bit. At the center shown on the pattern, bore ½" deep for the clock insert. Run your drill press at a low speed, 250–300 rpm, and grip the blank with a handscrew clamp.

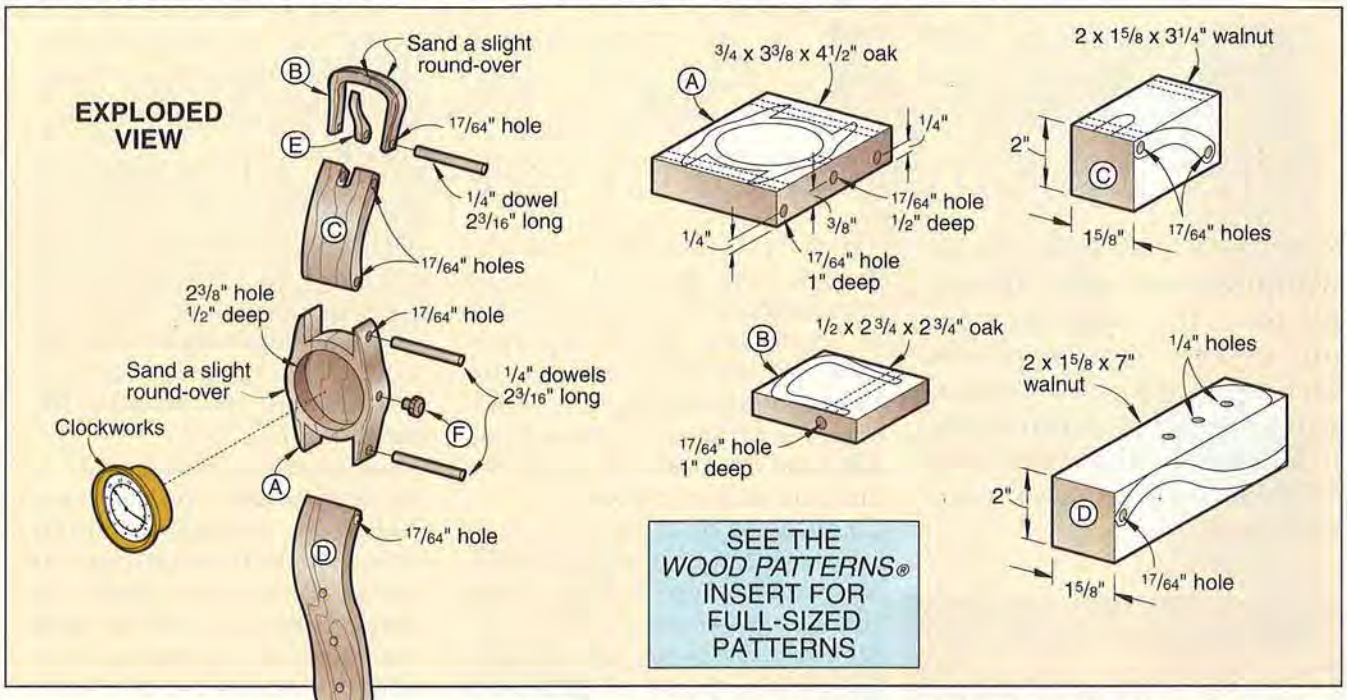
6 With a scrollsaw or bandsaw, cut the watch to shape. Carve or sand the lugs to ½" thick at the ends. Sand with progressively finer grits from 100 to 320.

Make the band and buckle

1 Apply the buckle pattern (B) to a ½×2¾×2¾" blank. (We used oak.) Orient the grain as shown.

2 Transfer the hole centerline to both edges of the blank. Mark a

A LARGE SCALE



center on each line at the middle of the edge. Chuck a 17/64" bit in your drill press, and drill about 1" deep at each center.

3 Scrollsaw the buckle. Sand round-overs on the outside edges, and thin the buckle slightly at the closed end.

4 Square the faces of a 2×2×12" walnut turning square. Rip the piece to 1⅝" wide. Adhere the Top View patterns for the watchband (C and D) to the narrow face. Position the Side View patterns on an adjacent face, aligning the ends on the side view with the ends on the top view.

5 Drill the 17/64" holes where shown on the side-view patterns for parts C and D. Drill all three holes through the blank.

6 Cut the parts to length, using the top-view patterns as guides. Saw the notched end of C and the tongue end of D. Bandsaw the side views.

7 Lay out the three buckle holes on the back of part D, referring to the top-view pattern. Drill the holes from the back of the part, keeping the drill bit perpendicular to the surface. Place scrapwood under the watchband to help hold it in position while drilling and to minimize tear-out.

8 Sand both parts, being careful to remove all saw marks. Sanding drums work well for this.

9 Apply the pattern for the buckle tongue (E) to ¼"-thick oak. Drill the 17/64" hole where shown. Scrollsaw the part to shape. Sand, rounding over all edges.

Just a little more time now

1 To make the stem (F), chuck a 1" length of ½" dowel into your drill press. Mark a line around the dowel about ¼" from the free end. With the drill press running, file or sand the dowel to ¼" diameter below the line.

2 Unchuck the dowel, and cut it to ½" overall length, measuring from the ¼"-diameter end. Sawing by hand with a coping saw or small backsaw is the safest way to make this cut.

3 Chuck the dowel by the ¼" end, then sand or file the large end to the rounded profile shown by the pattern. Unchuck the dowel, then file or carve notches around the edge of the large part.

4 Cut three 2 3/16"-long pieces of ¼" dowel rod for the strap pins. Refer to the Exploded View drawing, and test-assemble the parts. Now, glue the stem into the hole where shown.

5 Apply a clear finish to all parts, except the three dowels. Reassemble the watch, holding each dowel in place with a drop of cyanoacrylate glue at the end, if necessary. (Our ¼" dowels fit snugly enough in the holes that no glue was necessary.)

6 Install the clock battery, and set the time. Fit the clock into the watch body, then hang the watch on a wall or pass the strap through the buckle as shown for display on a desk or table.

Buying Guide

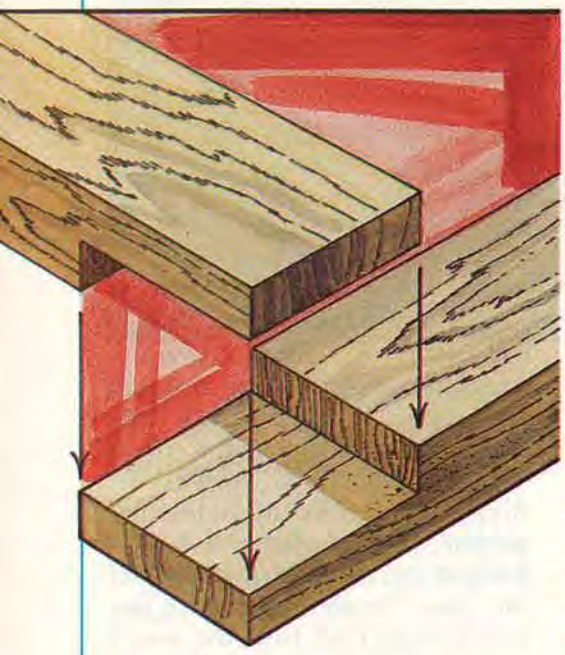
Clock insert. Quartz clock insert with brass bezel and white face, 2¾" diameter, fits 2⅜" hole. Item no. 200920, $15.50 ppd. in U.S. Schlabaugh and Sons, 720 14th St., Kalona, IA 52247. Call 800/346-9663 to order.

Project Design: Denis Sutter
Photographs: John Hetherington
Illustrations: Roxanne LeMoine; Lorna Johnson

HALF-LAP JOINTS

Plenty strong and easy to make

Sure, you can find woodworking joints more beautiful than the half-lap. And, one or two joints might be stronger. But few woodworking joints match the half-lap for all-around usefulness and ease of construction.



Just a few words before we make this joint

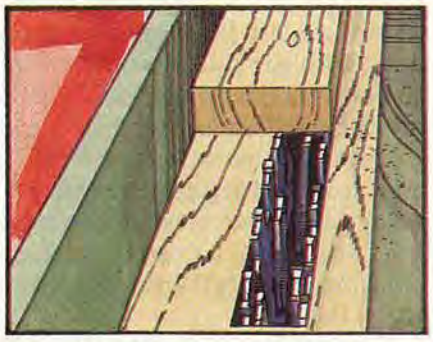
As you can see by the illustration *above,* a half-lap joint consists of two workpieces reduced to half of their thickness where they lap over each other. This provides a face-grain-to-face-grain joint with plenty of gluing surface. Simple butt joints, on the other hand, rely on an end-grain-to-edge-grain bond that can break easily. Even a dowel-reinforced butt joint won't prove as strong as a half-lap.

Half-lap joints do reveal end grain on both sides of the joint, so avoid using the joint where such an appearance proves objectionable. We often use half-laps for shop-cabinet door frames, workbench leg frames, outdoor furniture, and internal web frames for furniture such as dressers.

You need only a tablesaw or radial-arm saw to make a half-lap. We prefer to use a dado set for fast and smooth results.

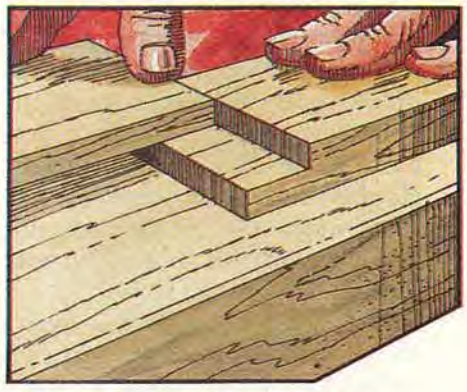
If you don't own a dado set that will cleanly shear cross grain and leave the sawn surface smooth and flat, we suggest you use a router table outfitted with a straight bit. Here, we show how to make corner- and T-joints with a tablesaw, but you easily can adapt these techniques to your radial-arm saw or router table.

Four easy steps to lap-joint success



1 Install your complete dado set so you get the widest cut possible with it (typically 13/16"). Raise the blade above the table (exact height isn't important yet). Adjust your rip fence so one edge of your workpiece butts against the fence and the opposite edge aligns with the side of the dado set farthest from the fence (as shown in the illustration).

If all of your workpieces are of the same width, you can leave your fence at this position for all of the following cuts. If you're working with pieces of different widths, keep in mind that you use a workpiece's adjoining piece to set the fence for its half-lap cut. For example, with a door frame use the horizontal workpieces (the rails) to set the fence for the cuts in the vertical workpieces (the stiles), and vice versa.

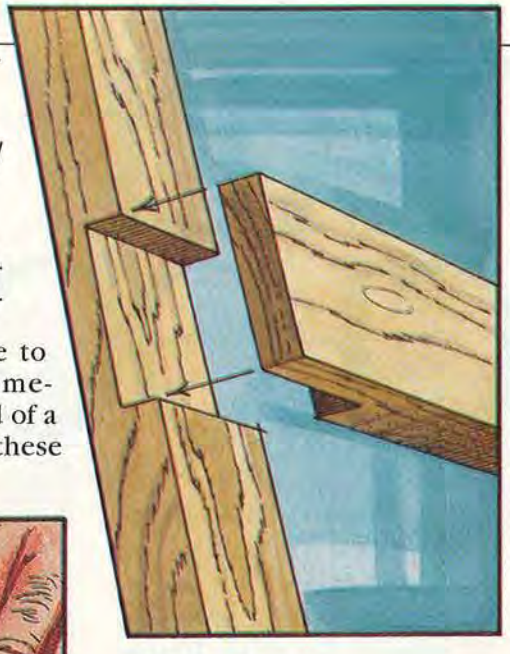


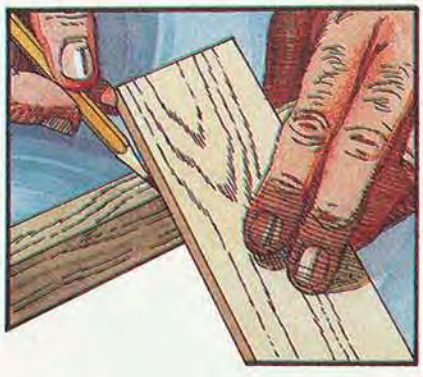
2 Set the cutting depth of the dado set so it removes precisely one-half of the workpiece thickness. Test your cutting depth with two pieces of scrap stock of the same thickness as your workpieces. After cutting the scrap pieces, lay them on a flat surface and align them as shown *above.* The top and bottom faces should be flush.

Print this article

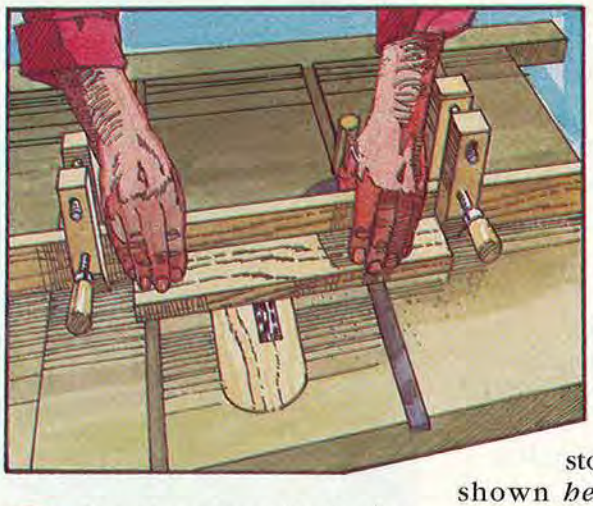
What you need to know to make a half-lap T-joint

Sometimes, you may have to place a half-lap joint somewhere other than at the end of a workpiece. Then, follow these two easy steps.



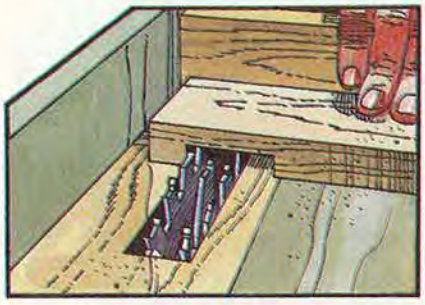


1 First, mark the position of the overlap onto the edge of the workpiece that will be cut in its midsection. For accuracy use a sharp pencil.



2 Set the unmarked edge against the miter-gauge auxiliary fence. Align the pencil marks with the sides of the dado set, and position two handscrew clamps as stops on the auxiliary fence. (If you don't have handscrew clamps, simply clamp two blocks of wood with C- or bar clamps.)

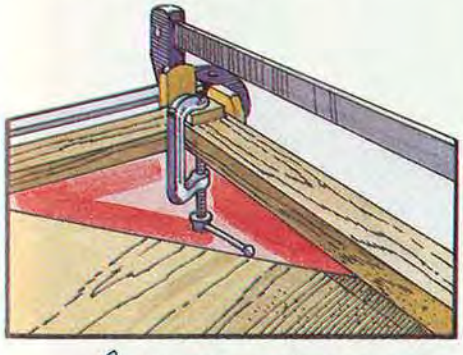
When positioned correctly, the stops will limit the area of removed stock to the space between the pencil marks. You simply butt one end of the stock against one stop and make a cut as shown *here*. Then, butt the other end of the stock against the remaining stop, and make another cut. Finally, remove the material between the two cuts. With the stops set up this way, you can make multiple pieces that will all turn out the same.



3 Mark the face sides of your workpieces so you don't get them confused. Keep in mind that you need to place the face side of one piece *up*, and the face side of the adjoining piece *down*, during this step.

Set your miter gauge for a square cut, and attach an auxiliary wooden fence to it. The auxiliary fence should come to within ½" of butting against the rip fence.

Now, position the workpiece with an edge against the auxiliary fence and an end butted against the rip fence. Turn on the saw, hold the workpiece firmly against the auxiliary fence, and pass the workpiece over the dado set. Make successive passes to complete the half-lap cut.



4 To clamp the joint, first apply wood glue to all mating surfaces. Draw the workpieces together with bar or pipe clamps. Then, bring the glued surfaces tightly together with a small clamp. Place a scrap of wood on the joint faces to protect them from the clamp jaws.

Written by Bill Krier with Chuck Hedlund Illustrations: Jim Stevenson

A WOOD MAGAZINE HEIRLOOM PROJECT

Graceful-and-easy TALL CLOCK

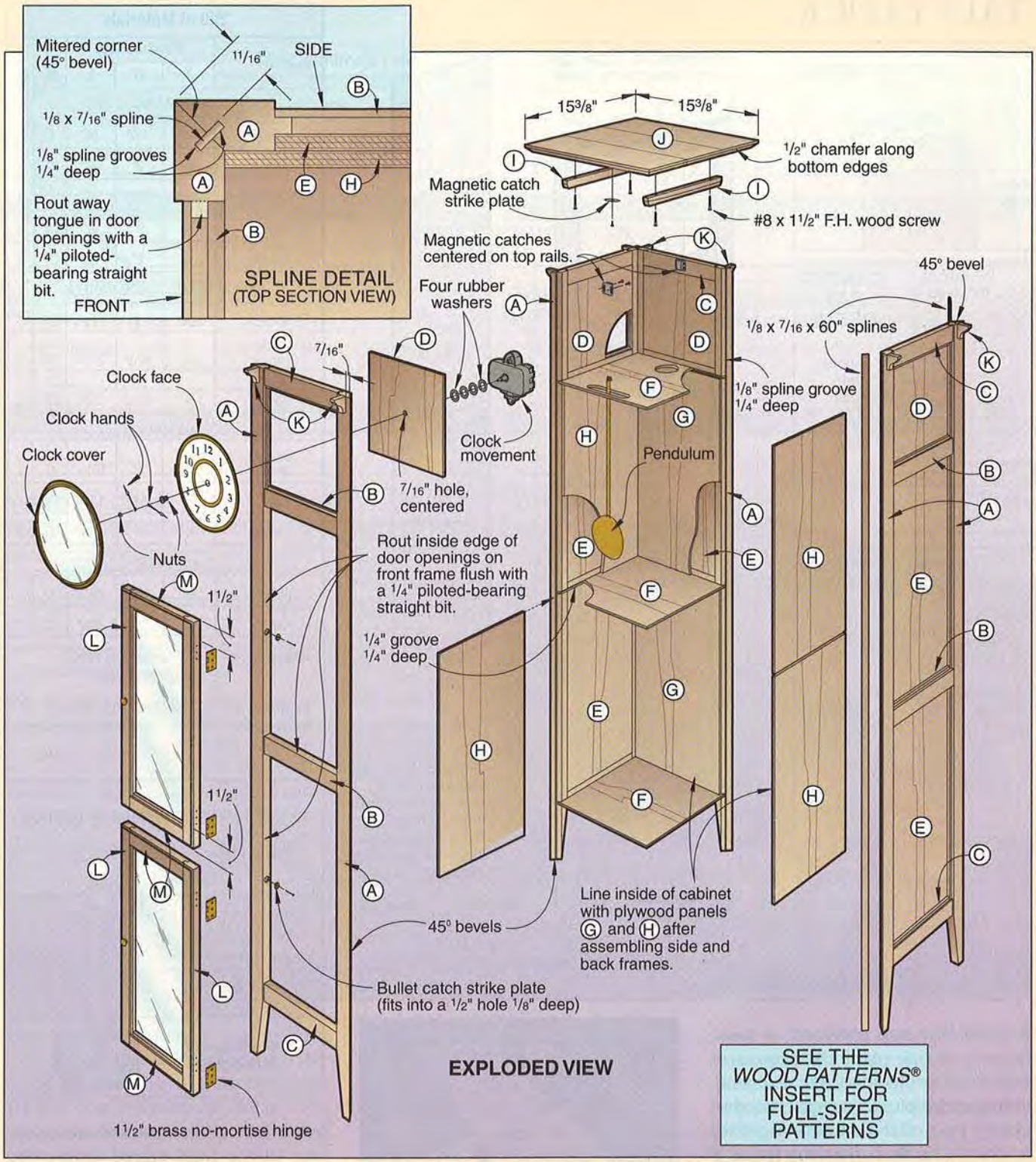
The project you see here is only the third tall clock we've published in over 12 years, so you know we think it's something special. Designed by John and Mark Schlabaugh, from Kalona, Iowa, this grandmother-sized clock reflects the simplicity of their Mennonite heritage. Also true to their upbringing, the brothers kept a watchful eye on cost when engineering this lovely 60"-tall timepiece. We rate this a "must-build" project.

Start with the front, back, and side frames

Note: *To keep the construction as simple as possible, we designed the carcase so the front, back, and side frames are identical in size.*

1 From ¾"-thick red oak, cut the front-, back-, and side-frame stiles (A) to size. (Select your own stock, or see the Buying Guide for our source of a hardwood kit.)

2 From ⅝" stock (we planed ¾" stock to this thickness), cut the rails (B, C) to size. (Make a few extra for making test cuts later.)



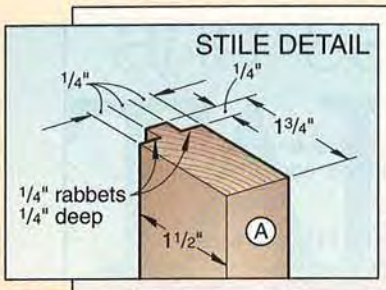
3 Fit your tablesaw with a ¼" dado blade. Using a tenoning jig or pushblock for support, cut a ¼"-deep groove along the ends of each rail where dimensioned on the details with the Frames drawing. Test-cut your extra pieces first to verify the setup. Mark an X on the front face of each piece for ease in assembly later.

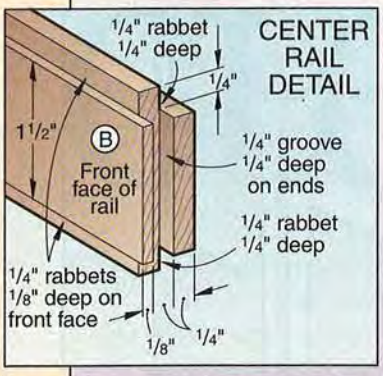
4 Cut rabbets along the edges of the stiles (A) and rails (B, C) to the depths noted on the two Rail details accompanying the Frames drawing. Cut both rabbets to create a ¼" tongue along the noted edges. Test-cut scrap stock first to verify that the resulting tongue along the inside edges of the stiles (A) fits snugly inside the mating ¼" groove in the ends of B and C.

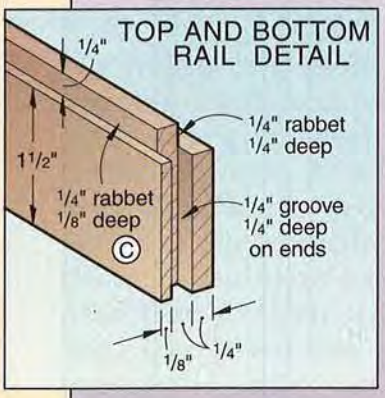
5 Mark the tapered bottom end of each stile (A). Bandsaw and sand the tapers to shape.

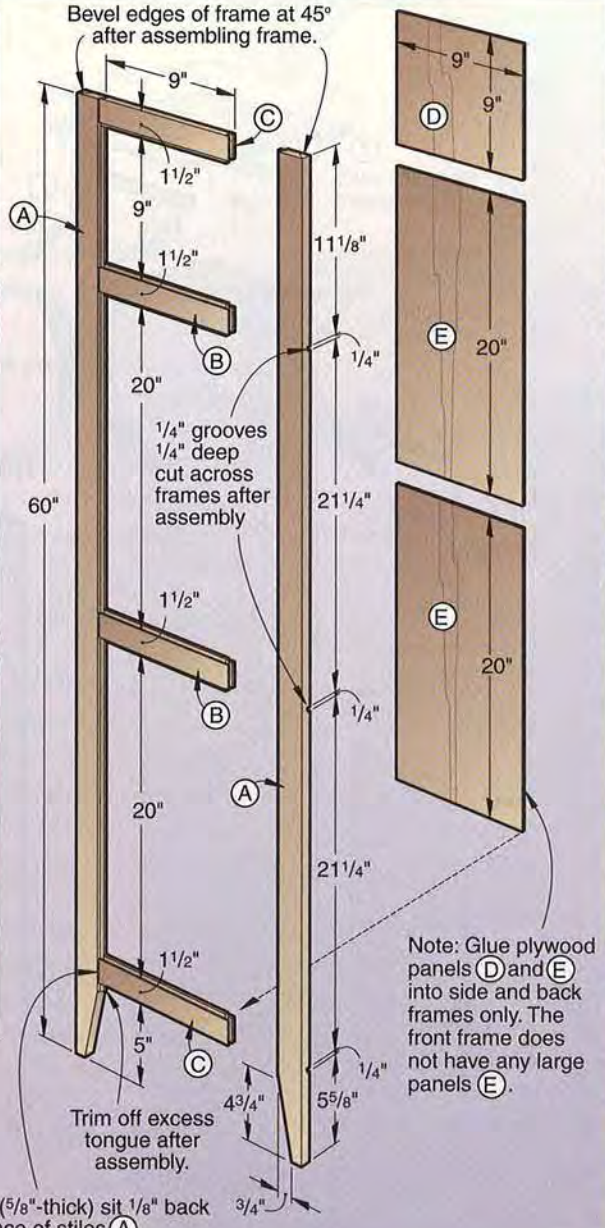
Continued

TALL CLOCK









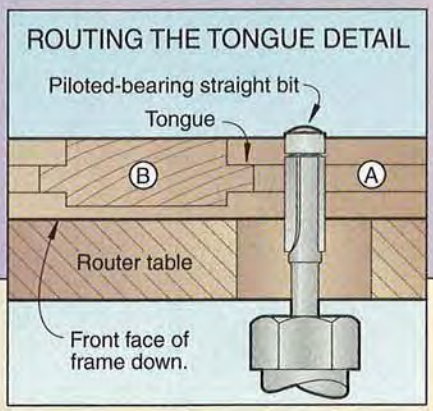
FRAMES
(FRONT, BACK, AND SIDE FRAMES)

Bill of Materials

Part	Finished Size T	W	L	Matl.	Qty.
FRAMES					
A stiles	¾"	1¾"	60"	O	8
B rails	⅝"	2"	9"	O	8
C rails	⅝"	1¾"	9"	O	8
D panels	¼"	9"	9"	OP	4
E panels	¼"	9"	20"	OP	6
DIVIDERS AND INSIDE PANELS					
F dividers	¼"	11"	11"	OP	3
G inside panels	¼"	10½"	21¼"	OP	2
H inside panels	¼"	10¼"	21¼"	OP	4
TOP AND BRACKETS					
I top cleats	¾"	1"	10⁷⁄₁₆"	O	2
J top	¾"	15⅜"	15⅜"	EO	1
K corbels	½"	1"	1¼"	O	8
DOORS					
L stiles	⅝"	1⅜"	19⅞"	O	4
M rails	⅝"	1⅜"	6⅝"	O	4

Materials Key: O–oak, OP–oak plywood, EO–edge-joined oak

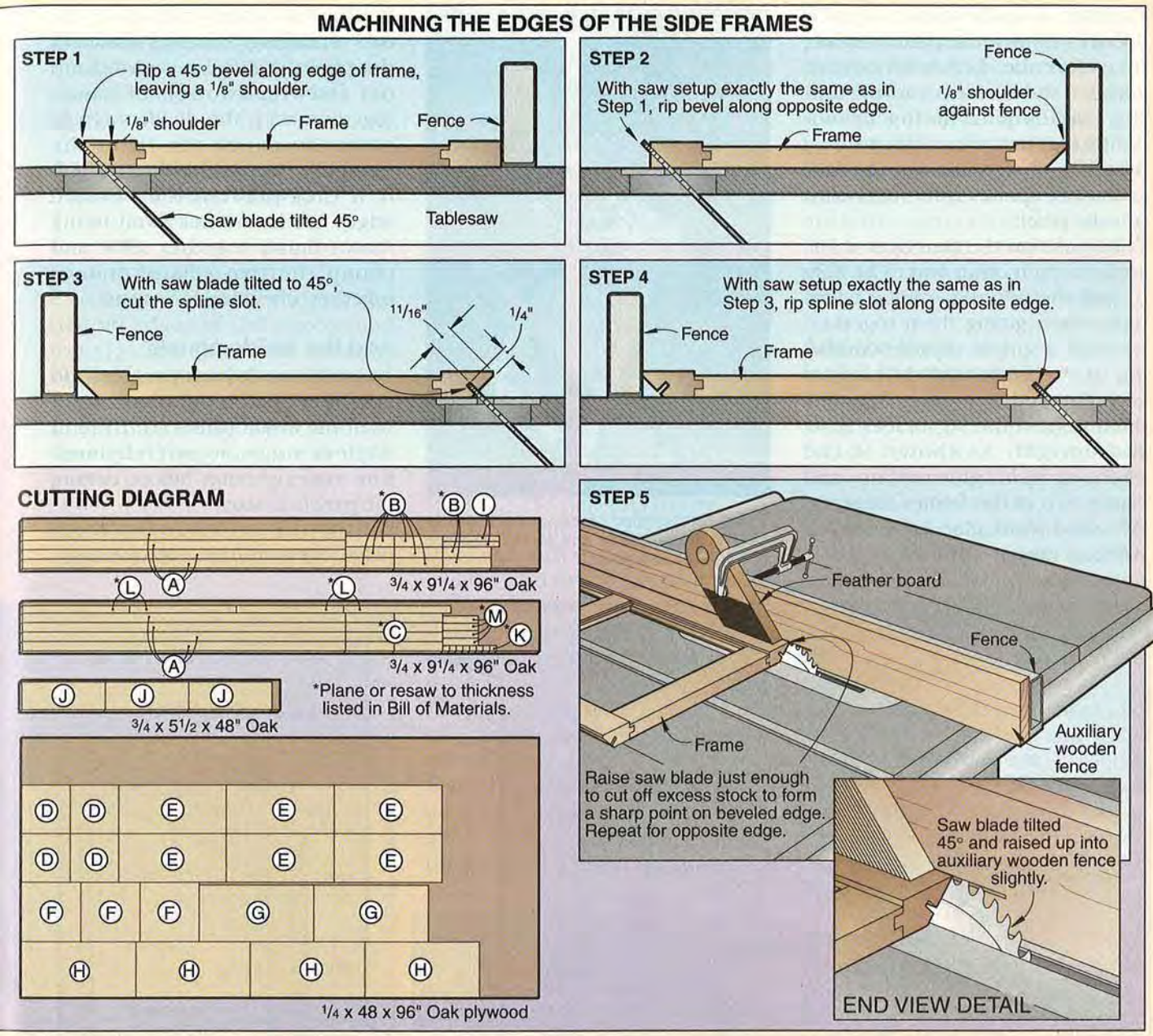
Supplies: #8x1½" flathead wood screws, ⅛" hardboard for splines, clear silicone sealant, glass, stain, clear finish.



6 From ¼" scrap plywood or hardboard, cut one piece the same size as D and two to the same size as E. Using these panels as spacers, dry-clamp one of the frames together to check the fit. Adjust the frame if necessary. Then, as shown in the photo at *right*, glue and clamp each of the four frames, checking for square.

7 Fit your table-mounted router with a piloted-bearing straight bit. Now, with the outside face of the frame down, rout away the tongue from the middle and bottom openings in the front frame where the two doors will go later. (See the Spline and Routing the Tongue details accompanying the Exploded View and Frames drawings for reference.) Putting the outside face down on your router table allows the bit's bearing to ride on the ¼" shoulder of the rab-

Use plywood spacers when clamping each frame together to help keep the frame members square and aligned.



bet. If the outside face was up, the ⅛" rabbet shoulder wouldn't be enough for the bit to ride on. Chisel the corners of these two openings to remove the remaining tongue left by the bit.

Here's how to machine and connect the four frames

1 To house the oak plywood dividers (F), use a ¼" dado blade in your tablesaw and cut ¼" grooves ¼" deep across the inside face of each frame where dimensioned on the Frames and Exploded View drawings. Use your tablesaw fence to accurately align the dadoes from one frame to another.

2 Using a ⅛" blade in your tablesaw, follow the five-step drawing *above* to machine the mating beveled edges of each frame.

3 Cut the plywood panels D and E to size, and check the fit in the rabbeted openings. If the panels fit too tight, trim 1/16" off one edge and one end of each. Finish-sand the panels. Glue the panels in place in the back and side frames. Remove any glue now with a damp cloth, or wait until it has formed a tough skin and carefully lift it off with a chisel.

4 Cut and sand the plywood dividers (F) to size. Lay out and cut the openings in the top divider for the clock pendulum and speaker where shown on the Top Divider drawing on the insert in the center of the magazine.

5 So the four frames will clamp tightly together later, sand a ⅛"

Continued

chamfer at each corner of each divider (F). See the pattern insert for reference. Left with square corners, the dividers can prevent the frames from being drawn tightly together when clamped.

6 To join the four frames, cut four ⅛×7/16×60" splines from hardboard or solid stock.

7 To position the frames at a 90° angle to each other and to be able to pull the mitered splined edges tight when gluing them together, we built a simple support consisting of two right-angled braces at each end and a spreader between them to hold the 90° braces apart and upright. As shown in the photo at *right*, glue, spline, and clamp two of the frames together. (We used white glue for extended working time.)

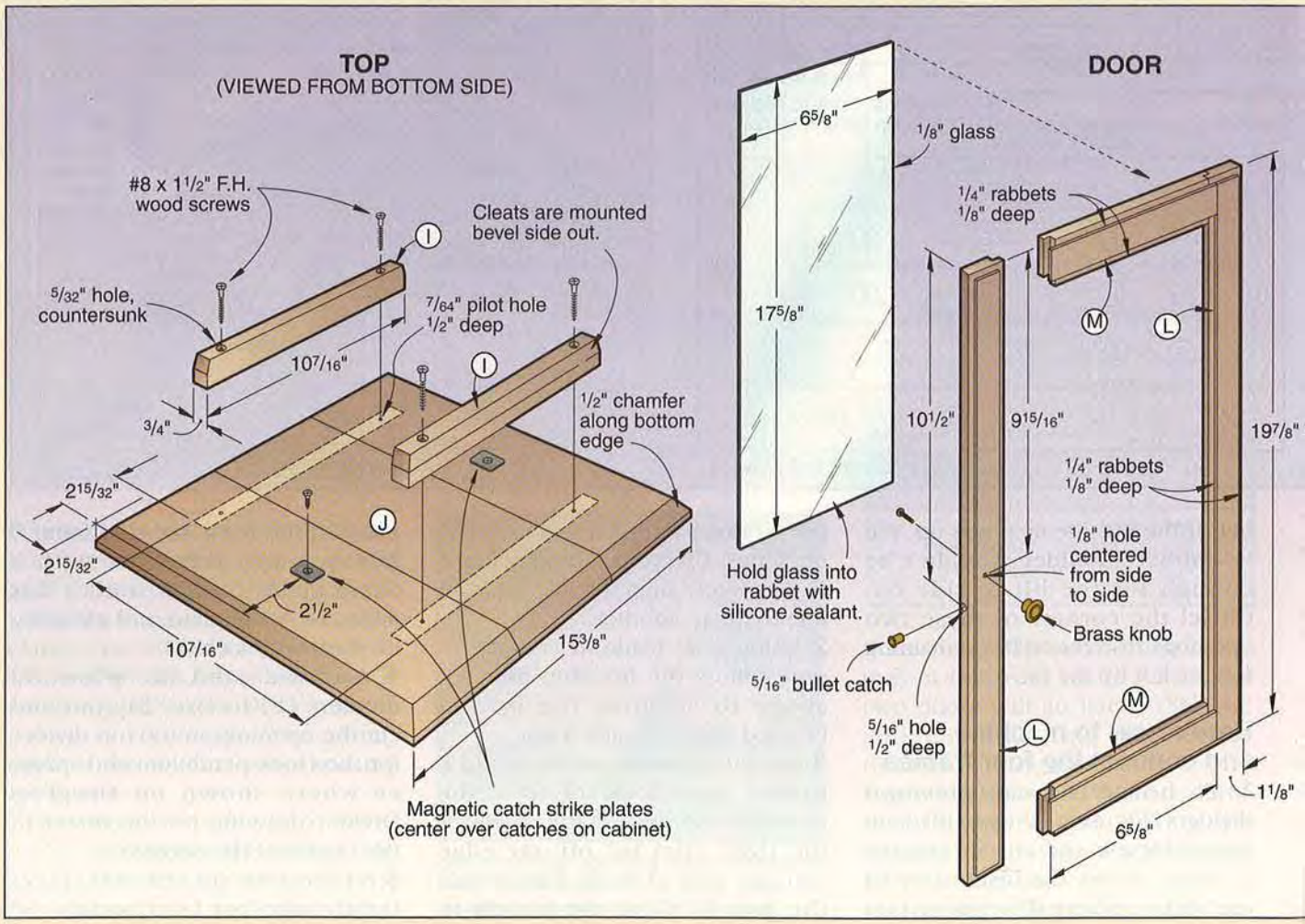
Using right-angled pieces at each end to keep it square, glue and clamp together two frames at a time.

8 Glue and clamp together the two remaining frames as shown in the photo at *left*. Later, dry-clamp (no glue) the two sets of frames together, with the dividers (F) in place, to check the fit of the assembly. Trim the dividers slightly if they prevent the beveled edges of the frames from being drawn tightly together. Glue and clamp the two sets of frames together, checking for square.

Add the inside panels

1 Cut the inside back panels (G) to size from ¼" oak plywood. You'll want the inside panels (G, H) to fit without a gap, so carefully measure your openings before cutting the panels to size.

2 Glue the back panels (G) in place. Measure the side openings,



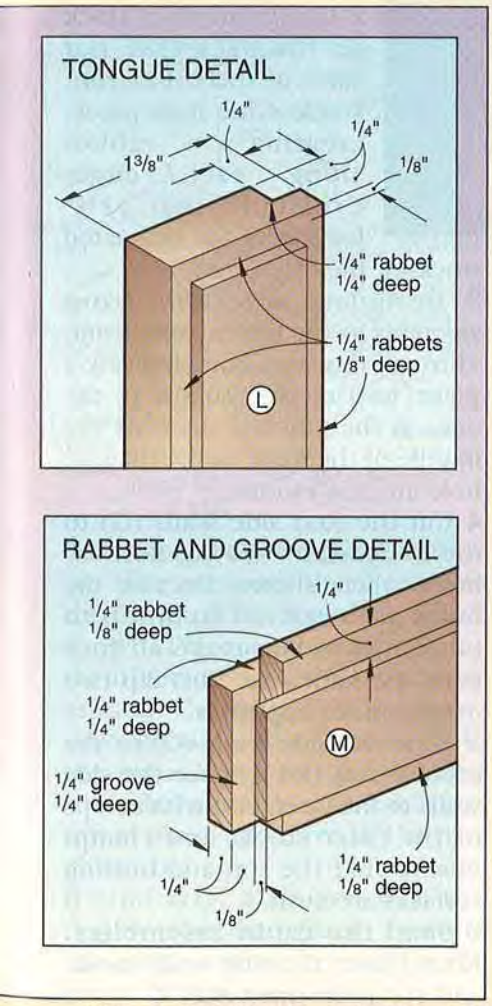
cut the inside side panels (H) to size, and glue them in place. Use the side panels to hold the back panel firmly in place while the glue dries.

A removable top makes for easy access

1 Cut the cleats (I) and top (J) to size. (We edge-joined narrower stock to form the top.)

2 Rout a ½" chamfer along the bottom edges of the edge-joined top (J). You also could form the chamfer using your tablesaw. Sand the chamfered edges.

3 Drill mounting holes through the cleats. Then, sand or cut slight bevels on the outside edges and ends of each cleat (I). See the Cleat drawing on the pattern insert for reference.



4 Carefully position and screw the cleats (I) on the bottom side of the top (J) so the top will sit centered on top of the carcase.

5 Screw magnetic catches to the front and back top frame rails (C). Then, add the strike plates to the bottom side of the top.

6 Transfer the corbel pattern (K) from the pattern insert to ½" stock eight times. Scrollsaw the corbels to shape and glue them to the outside of the carcase flush with the top edge and 7/16" in from each edge of each panel.

Add a pair of glass-paneled doors

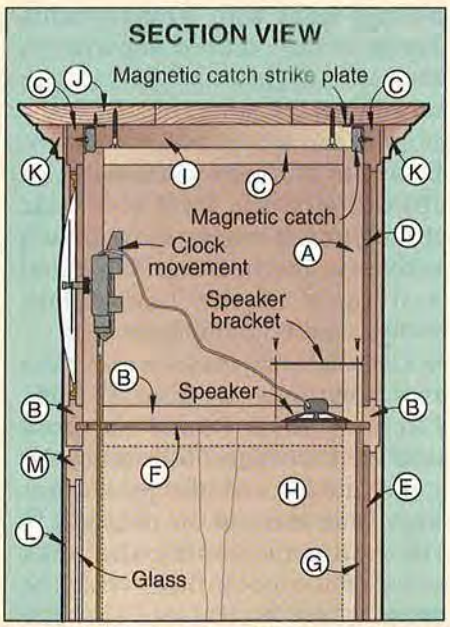
1 From ⅝" stock, cut the door stiles (L) and rails (M) to size.

2 Machine the inside edges of the stiles and rails using the same procedure used to machine the inside edges of the frame members.

3 Glue and clamp each door together, checking for square.

4 Rout a ¼" rabbet ⅛" deep along the front outside edges of each door frame. See the Door drawing for reference.

5 Drill a mounting hole in each door for a brass knob. Then, drill a 5/16" hole on the same edge as the knob for a bullet catch.



6 Drill pilot holes, and attach a pair of no-mortise hinges to the doors and then to the carcase. The front surface of the doors should be flush with the front surface of the rails (B, C), and ⅛" behind the front surface of the stiles (A). Swing the doors closed, mark the mating location on the inside edge of the front left-hand stile (A), and drill a ½" hole ⅛" deep for the bullet-catch strikes.

Add the finish and install the movement

1 Remove the hardware. Finish-sand the carcase, top, and doors. Finish as desired. (We applied Minwax Provincial Stain and Deft Semi-Gloss Clear Finish.)

2 Have a pair of glass panels cut to size. Install the panels into the back side of each door with a fine bead of clear silicone.

3 Reattach the hardware to the doors, and secure the doors to the front frame.

4 Install the clock movement and speaker where shown on the Section View drawing. Use rubber spacers between the clock-face panel (D) and the clock movement. This positions the pendulum slightly farther back from the back edge of the top front door.

Buying Guide

Hardware kit. Clock movement, face, cover, and pendulum; 2 pair of 1½" brass no-mortise hinges; 2 brass knobs; 2 magnetic catches and plates; 2 bullet catches. Kit no. FC96, $84.50 ppd. Schlabaugh and Sons Woodworking, 720 14th Street, Kalona, IA 52247 or call 800/346-9663 to order.

Hardwood kit. All of the pieces shown on the Cutting Diagram cut slightly oversized from the thicknesses listed in the Bill of Materials. Available in oak. W90, $99.95 ppd. Heritage Building Specialties, 205 North Cascade, Fergus Falls, MN 56537. Or call 800/524-4184 to order.

Written by Marlen Kemmet Project Design: ©Schlabaugh and Sons Illustrations: Kim Downing; Lorna Johnson Photographs: Wm. Hopkins; John Hetherington

STEAMBOAT

Back in Huck Finn's day, stern-wheel steamboats ruled America's mighty rivers. This one's sure to become the flagship of the playroom fleet as soon as you build it.

Start with the hull

1 Cut the hull (A) to the size shown in the Bill of Materials. On the bottom, lay out the taper, the stern-wheel well, and the front-wheel mortise, shown on the Parts View drawing, *page 100*.

2 Drill a 3/32" hole 2 3/8" deep into the hull edge where shown. The hole extends 1/2" past the hull's centerline. If your bit isn't long enough, you can deepen the hole after you cut the hull to shape.

3 Form the mortise for the front-wheel well. To do this easily, bore a 5/8" hole at each end of the mortise, then scrollsaw out the waste between them.

4 Bandsaw the hull. Shape the bottom front with a rasp, rounding it to the contour shown. On the sides, slight round-overs taper off toward the stern, ending at the front of the wheel well.

5 Lay out the stern-wheel bearings (B) on 3/8" stock. Drill a 1/4" hole through each where shown, then scrollsaw the bearings. Glue and nail them to the hull where shown. Sand the hull smooth.

6 Cut the boat deck (C) and the two cabin tops (D) from 1/8" Baltic birch plywood. Round the front and back corners, following the radius guides with the parts drawings. Glue and nail the deck (C) to the hull, positioning the back edge of the deck flush with the stern-wheel well. Note that the deck mortise is shorter than the hull mortise.

Build the superstructure

1 Construct the cabin fronts by laminating two pieces of stock, one 3/4×2 3/4×12" for the front walls (E) and another 3/4×2×12" for the fillers (F). (We picked the length arbitrarily for safety and convenience.) Rout a 1/2" round-over along both edges of one side of the wider stock.

2 Center the filler stock on the back (the flat side) of the cabin-front stock. Glue it in place, creating a 3/8" rabbet along each edge. Crosscut two 1 1/8" lengths of the laminated stock for the cabin fronts.

3 Designate one cabin front assembly as the lower cabin front. Through this one, bore and saw a wheel-well mortise similar to the ones in the hull and deck. At the middle of the front wall, drill a 1/8" hole into the mortise.

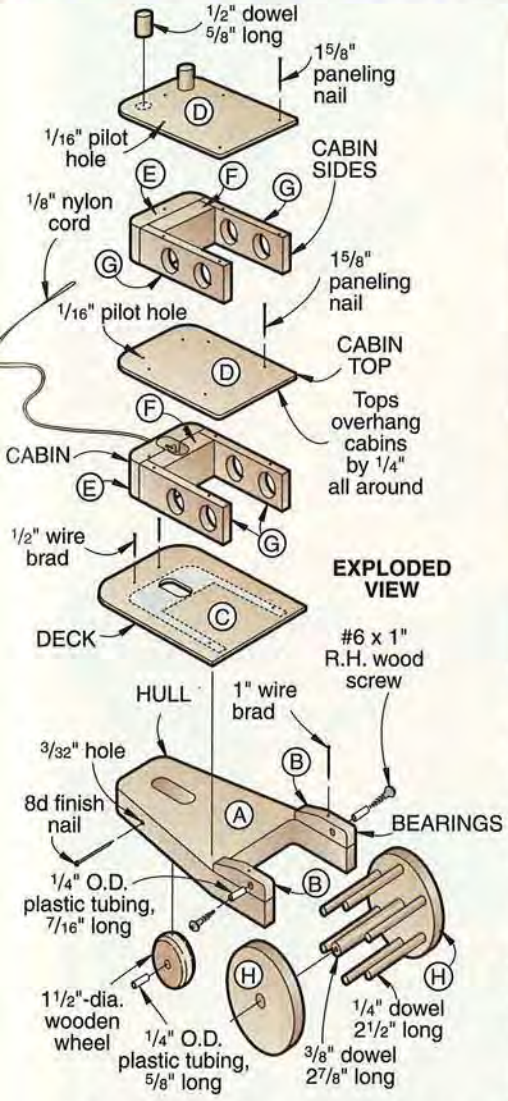
4 Cut the four side walls (G) to the dimensions shown. Bore 3/4" holes where shown. Because the holes are centered from top to bottom, you can make all four parts the same, then just flip two over to make opposites.

5 Glue the side walls (G) to the cabin fronts (E/F). Space the side walls at the open end with scraps of the filler stock, and clamp. Ensure that the top and bottom surfaces are flush.

6 Sand the cabin assemblies. Round over the side walls inside and out at the open end.

Print this article

ON A STRING



7 Position the lower cabin assembly (the one with the mortise in the front) on the boat deck where shown. Place a cabin top (D) on it, allowing a ¼" overhang all around. Carefully drill 1/16" holes through the cabin and top into the hull, shown in the Exploded View drawing. Glue the cabin and top in place, and drive in 1⅝" paneling nails.

8 Similarly, glue and nail the upper cabin into place. Position the nails to miss the ones in the lower cabin.

Bill of Materials

Part	Finished Size T	W	L	Matl.	Qty.
A hull	¾"	3¾"	8"	P	1
B bearings	⅜"	½"	2⅜"	P	2
C deck	⅛"	3⅞"	5⅞"	BB	1
D cabin top	⅛"	3¼"	5⅛"	BB	2
E front wall	¾"	2¾"	1⅛"	P	2
F filler	¾"	2"	1⅛"	P	2
G side wall	⅜"	1⅛"	3⅞"	P	4
H wheel	⅜"	2⅞" dia.		P	2

Materials Key: P–poplar
BB–Baltic birch plywood

Supplies: ¼", ⅜", and ½" dowels; #17x½" and 1" wire brads; 8d finish nail; 1⅝" paneling nails; 1½"-dia. wooden toy wheel; ¼" O.D. plastic tubing; #6x1" roundhead wood screws; nylon twine; glue; gloss enamel paints.

9 Countersink and fill all exposed nails. Sand the completed hull and superstructure to 220-grit in preparation for painting.

Put together a paddle wheel

1 Lay out the wheels (H) on ⅜"-thick stock. To space the six ¼" holes evenly, first draw a circle with a 1⅛" radius on the blank. Then, without changing the compass opening, put the point anywhere on the circle. Swing the pencil across the circle to make a mark. Move the compass point to that mark, and swing another arc, and make another mark. Continue around the circle.

2. Cut out the two wheels with a hole cutter set to 1 7/16" radius. Drill the ¼" holes ¼" deep, then enlarge the center hole to ⅜". Sand the wheels, giving the edges a slight round-over.

3 Cut six 2½"-long pieces of ¼" dowel rod and one 2⅞"-long piece of ⅜" dowel rod. Referring to the Exploded View drawing, glue the paddle wheel together. The ⅜"-diameter axle should extend 1/16" beyond the outside of the paddle wheel on each side.

4 Mark the center of the axle on each end. Drill a ⅛" hole ½" deep straight into each end.

Paint and assemble the boat

1 Cut two pieces of ½" dowel rod ⅝" long for the smokestacks. Glue them to the cabin top where shown in the illustration.

2 Paint the boat and the paddle wheel separately, following the color scheme shown (or your favorite colors). We used gloss enamel paints.

3 Tie a finger loop in one end of an 18" length of nylon twine about ⅛" in diameter. Push the other end through the hole in the front of the cabin until it dangles out of the wheel well. Tie a large knot in the end, and pull the string until the knot stops on the inside of the cabin front.

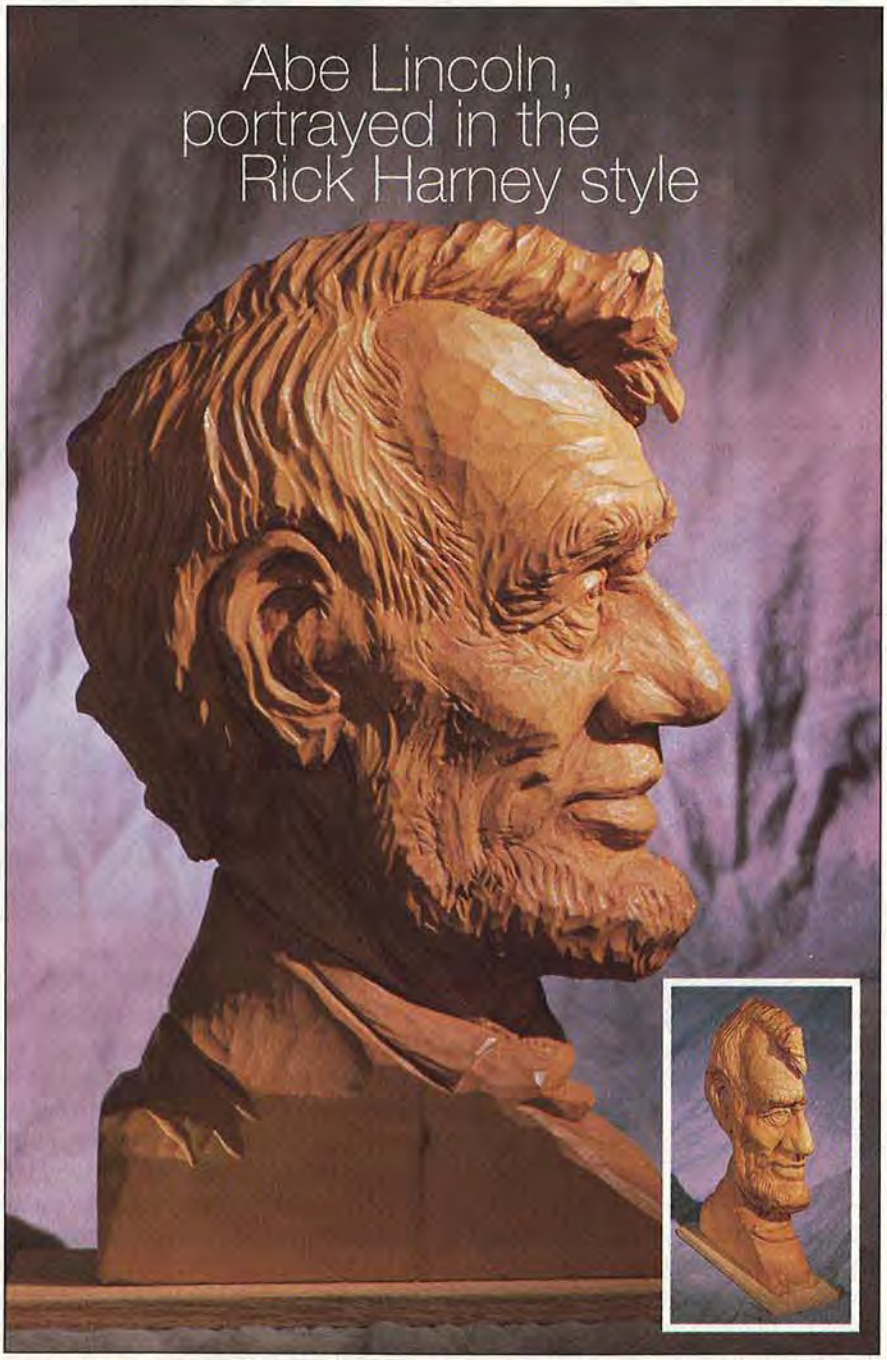
4 Install the front wheel. Cut a piece of ¼"-outside-diameter plastic tubing ⅝" long, and insert it into the hole of a 1½"-diameter wooden wheel. Insert the wheel with the tubing bushing into the front wheel well, and pin it in place with an 8d finish nail. Fill the nail hole and touch up the paint, if you wish.

5 Finally, install the paddle wheel. Cut two 7/16"-long bushings from the ¼" plastic tubing, and slip them into the holes in the paddle-wheel bearings. Drill out the bushings if necessary to allow a #6x1" roundhead screw to slide through them. Then, position the paddle wheel, and drive a screw into each end of the axle.

Project Design: ©Russell Lasho
Illustrations: Roxanne LeMoine
Photograph: Hopkins Associates

PROFILE OF A

Bloomington, Illinois, artist and carver Rick Harney pays tribute to another notable son of Illinois in this exceptional carving. Here's how to carve your own copy of Rick's portrait of Abe Lincoln.



Project prep
Stock: Machine-carved roughout, see the Buying Guide on *page 71*.
Carving tools
Gouges
No. 5: ½", ¾", 1"
No. 7: ½"
No. 9: ½", ¾"
U-veiner: ¼"–½"
V-tool: ¼"–½"
Knife

Note: These instructions cover detailing and finishing a machine-made roughout of the Abe Lincoln bust (see the Buying Guide). A casting of the original Rick Harney carving is available as a carving aid.

Rick Harney's carvings always take you by surprise. Looking straight at one, you immediately drink in its splendid detail. Then, moving to view it from a slightly different angle, you find there is no other angle—it's flat! Rick's 11" Lincoln bust *right* measures only about 1¾" thick at most.

When we visited Rick's studio in Bloomington, Illinois, not too long ago, he carved a copy of his Lincoln bust for us, starting with a roughout machine-made from his original carving. Here's how to carve one yourself, starting with the same roughout.

Surface the roughout

Before starting, screw a piece of plywood about 12×16" to the back of the roughout to make it easier to hold. Any thickness from ½" to ¾" will work.

With the roughout centered on one side of the plywood, drive a couple of #6 flathead wood screws through the back of the plywood into the back of the roughout. The screws need to be long enough to extend about ¾" into the roughout. Clamp the mounting board to your bench or hold it with a bench hook.

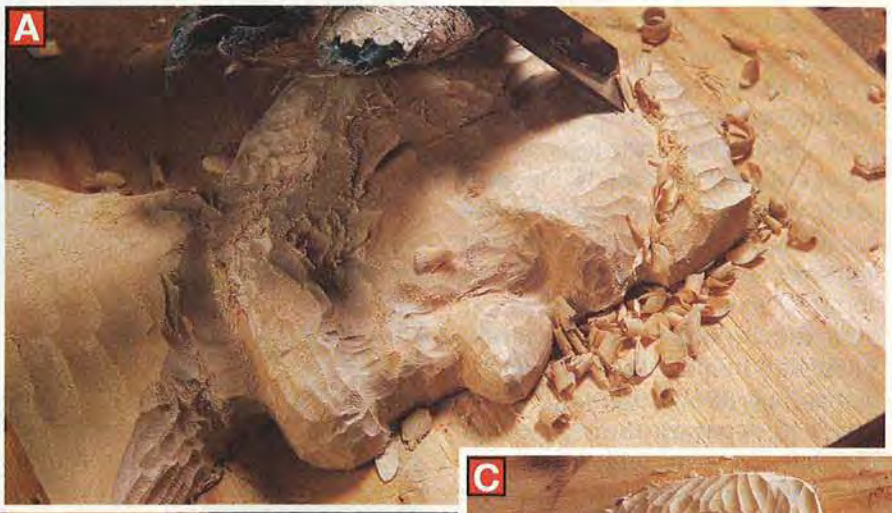
Using a wide, medium-sweep gouge (Rick uses a 1"-wide no. 5), remove the machine marks and smooth the surface. Rick prefers gouges for most aspects of the carving. "As much as possible, avoid using a knife," he advises.

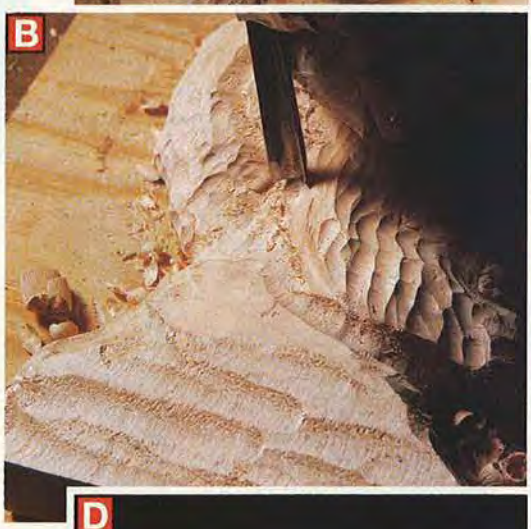
PRESIDENT

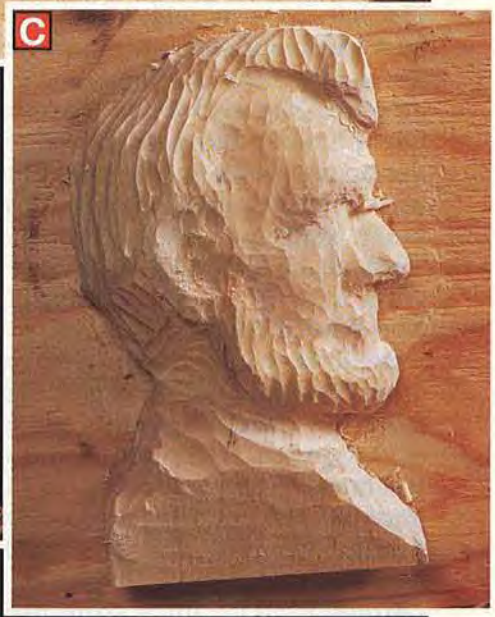
Don't cut much from the nose just yet. "You can clean up the nose nicely by using the gouge upside down," Rick points out. Smooth the skin between the hairline and beard, and eliminate any flatness, as shown in *Photo A*.

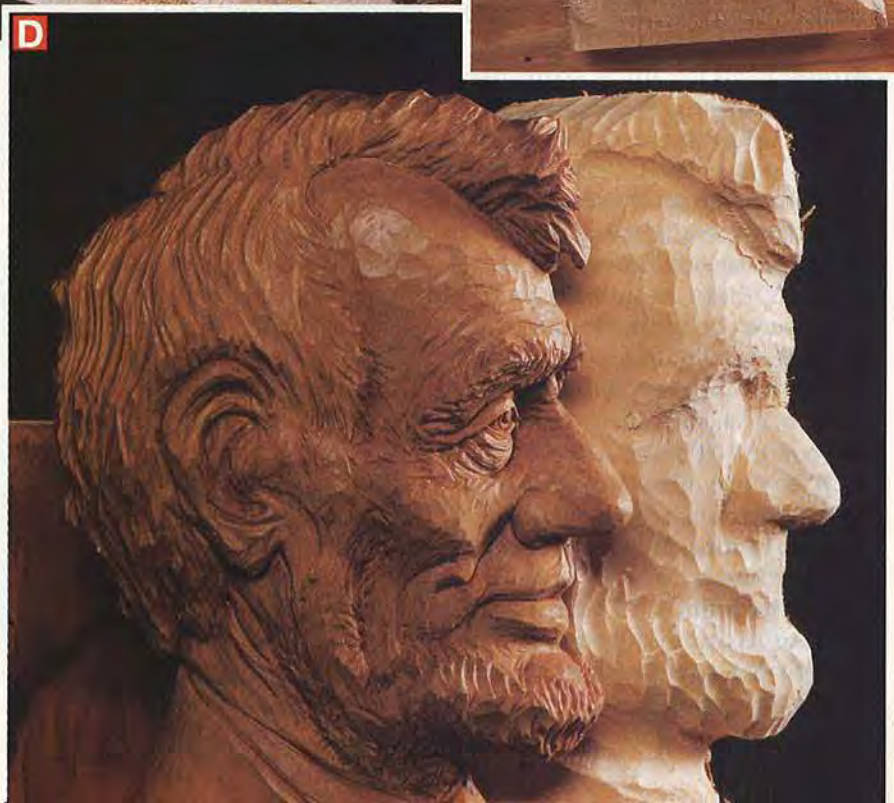
Texture the hair and beard with a deeper, narrower gouge. (Rick recommends a ½" or ¾" no. 9.) "Working with the roughout, there isn't much shaping needed, but you do need to develop the flow of the hair and beard," Rick says. Form troughs of varying width and depth to create the texture, as in *Photo B*.

Pare away a little wood to separate the lower lip from the beard. With the skin smoothed and the hair and beard textured, your carving should now look much like the one in *Photo C*.









Mr. Lincoln stands tall

Before going any further, remove the carving from the mounting board so you can reposition it. Holding the board and the carving vertically, place the board's upper right corner behind the carving's eye area. Reattach the workpiece to the board.

Hold the carving upright by clamping the lower part of the mounting board in a vise. Working with the carving vertical—the viewing position—allows you to see more accurately how the finished carving will appear.

"From now on, you need to observe light and shadows on the surface," Rick remarks. "Many of the details and textures are shallow; shadows give them depth."

A presidential profile

The roughout's facial profile looks flat, compared with that of the completed carving (*Photo D*), so you'll have to cut in a few details.

Continued

PROFILE OF A PRESIDENT

Establish your carving's profile, referring to the photograph or the study cast (see the Buying Guide).

"It's important to extend the top line of the nose," Rick says, "but don't take much off the side of it, yet." Continuing the slope of the nose, cut into the face ¼" or so to form the brow line. Above the brow line, cut back toward the hairline. The hair should stand out about ½" from the forehead.

On the eyebrow ridge, carve a slight hollow near the edge of the blank (just above the side of the nose) to separate the eyebrows. The left eyebrow will, of course, be a mere hint, but it needs to be distinct from the right one.

Hollow the area between the lower lip and the beard to define the lip, as shown in *Photo E*. Cut in the mouth opening. With a knife, stop-cut under the nose. Then, shape the upper lip.

See what's next

Now, form the lower eyelid. Make an arcing gouge cut, beginning from the cheek, bending down slightly, then sweeping up onto the bridge of the nose, shown in *Photo F*. The cut should start low on the face, just above the swell of the cheek.

Add the facial lines from the nose out to the cheek, shown in *Photo G*. The curled chips indicate the end of the U-veiner cuts.

From the middle of the eye area, cut across toward the nose with the gouge, turning inward next to the nose. Right beside the nose, it's about ½" deep (measured from the bridge of the nose).

Curve the eye toward the side of the face, too, forming an almond shape. Don't let it protrude too much; the eye must sit back in the face to prevent the bug-eyed look. With the veiner, cut in the curved upper lid line shown in *Photo H*.

With the almond form established, cut the eye opening and the eyeball's round iris into it. The iris measures about 5/16" in diameter, and the center lies about ¾" from the back edge of the carving.

Stop-cut around the iris with a gouge of appropriate sweep or a knife. Then, stop-cut the upper and lower lids on both sides of the eyeball. Pop the waste triangles out of the corners, and clean out around the iris, shown in *Photo I*. "It's better to err on the side of too small for the eye opening rather than too large," Rick advises. "You can always incorporate any extra material around the eye into the eyelid."

With a V-tool, cut in the fold in the upper eyelid, as in *Photo J*. Shave the upper lid down slightly to reduce bulk. Then, shave down the side of the nose at the bridge, creating a slight hollow. "This gives a nice, hard shadow to set off the eye," Rick comments.

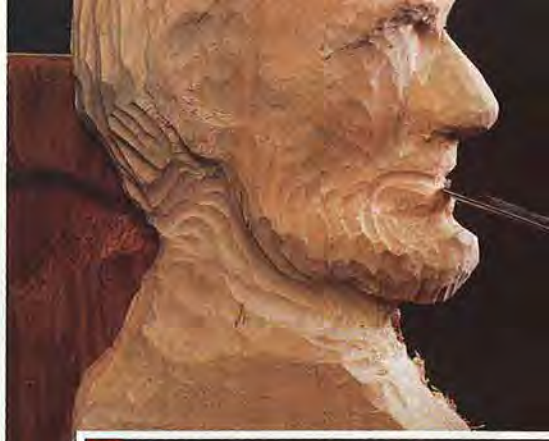
Delineate the pupil with V-tool cuts, then detail the lower lid's folds and wrinkles, as shown in *Photo K*. V-cut crow's-feet at the corner of the eye.

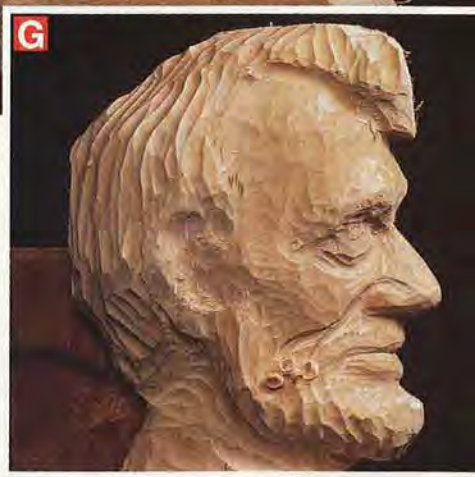
Shape the lower part of the nose. Cut in a shallow indentation to represent the nostril. About ⅛" from the edge, carve the philtrum (the shallow flute that runs from the upper lip to the nose). Make it about ¼" wide.

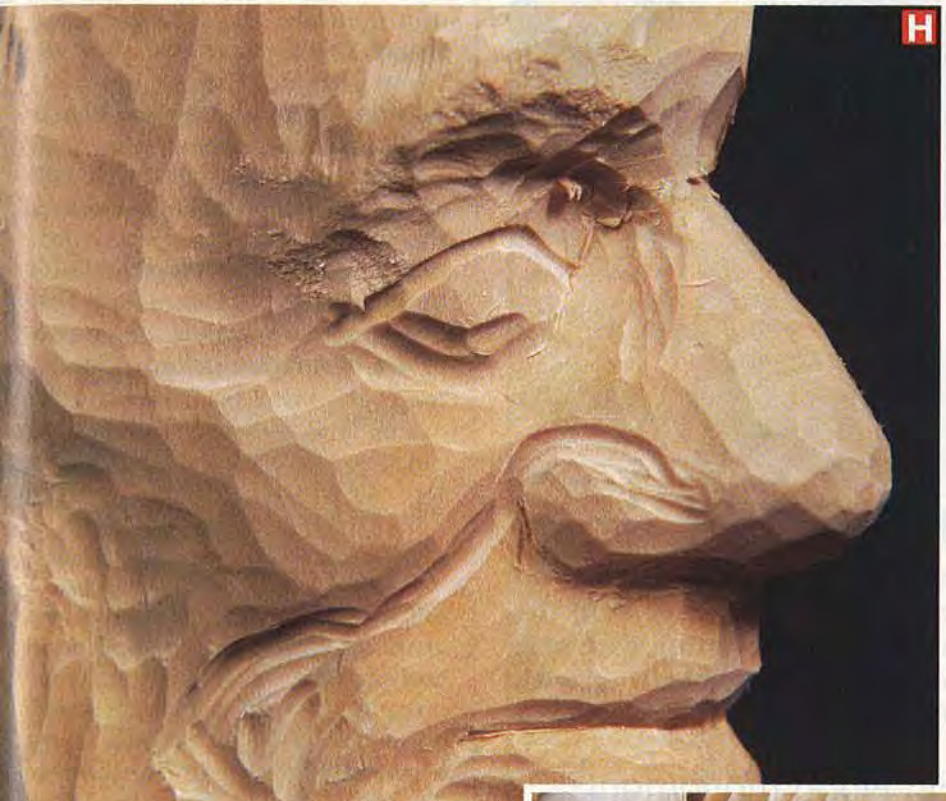
Take care of some details

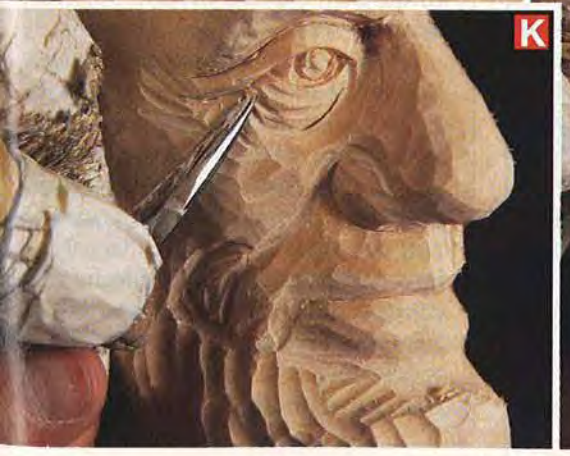
Cut the frown line, running downward from the corner of the mouth. "Lincoln had really sunken jowls, so hollow out the area behind the mouth going toward the beard, leaving a prominent cheekbone," the carver says.

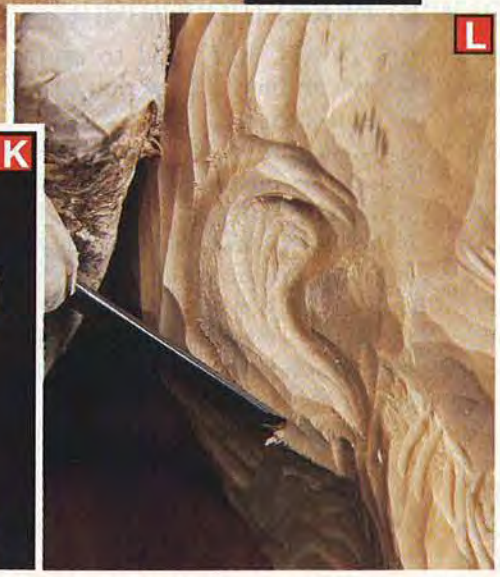
Cut around the inside of the ear, then define the outside, as shown











in *Photo L*. "You don't have to take much off," Rick warns. "For the shape, think of the ear as a series of bass clefs, or C-shapes."

After delineating the ear, stop-cut from the top front around the back to the back of the lobe, then pop out a sliver of wood to separate the ear from the hair. Shave down the front of the ear and the cheek, leaving the sideburn slightly raised from the face.

Stop-cut the hairline with a gouge (Rick uses a no. 5 about ½" wide for this). Shave the surface down to the stop cut, slightly raising the hair.

Texture the hair, eyebrows, and beard with a U-veiner. As you texture the beard, establish a bald spot between the lower lip and chin whiskers. Start with some longer cuts to suggest flow, then bring in some irregular, short strokes. "Strokes of different sizes, kind of irregular, make a more natural look," Rick says.

Make a hint of the left eyebrow on the edge of the carving. Furrow the presidential forehead with a few veiner cuts for wrinkles. Surface the neck and shoulders at the bottom of the carving, removing the machining marks.

Finish it as you prefer. Rick often paints his carvings, but this one looks great with just a coat of clear lacquer.

Buying Guide

Roughout. Machine-carved basswood roughout, $25.95 ppd. in U.S. The Woodcraft Shop, 2724 State St., Bettendorf, IA 52722, or call 800/397-2278 to order.

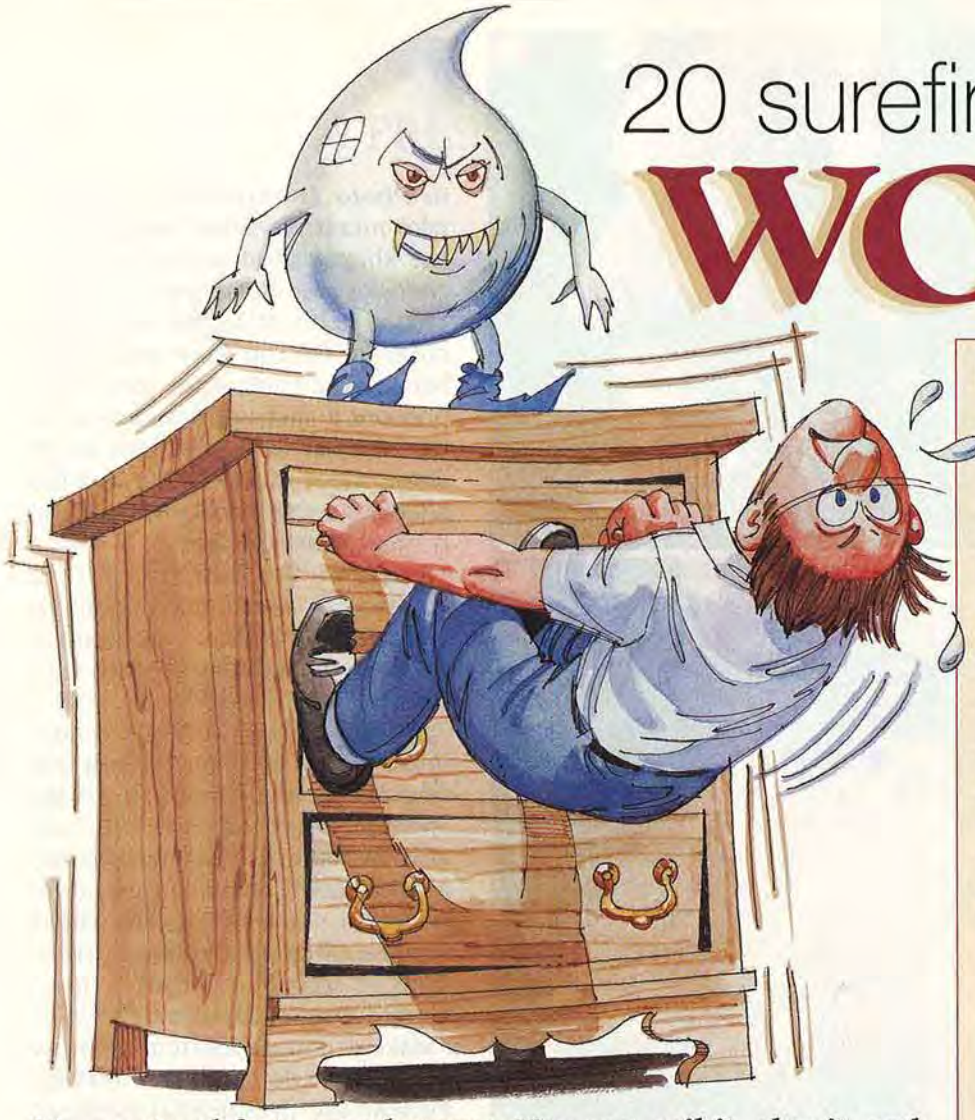
Study casting. Plastic reference casting of original carving. $30.95 ppd. in U.S., address above.

Carver's combo. Roughout and casting together, $53.95 ppd. in U.S., address above.

Tools listed also available from the Woodcraft Shop.

Project Design: Rick Harney Photographs: Todd Phillips, Bloomington Camera Craft Written by Larry Johnston

20 surefire strategies
WOOD



It's a natural fact—wood moves. You can nail it, glue it, and reinforce it by all possible means, but you'll never stop the wood in your projects from shrinking and swelling with seasonal changes in humidity. So, the secret to dealing with wood movement is to work *with* it, not against it.

Why you need to deal with wood movement

Like many things in Mother Nature's realm, wood is simultaneously one of the most perfect *and* imperfect materials available to us. We love it for its beauty, for the ease with which we can cut, shape, and bend it to suit our needs, and for its abundance.

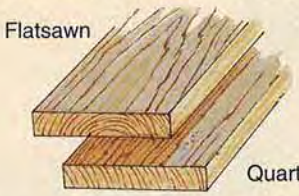
But, more than one woodworker has forgotten how much he loves wood when a gaping crack opens up in the dining table he spent weeks building. Or when a drawer containing his car keys won't open because its front has swelled tight inside its frame. Wood movement also can cause joints to open up. Doors that used to swing freely can bind if they don't have room to grow.

These things happen because wood was once a living organism with cells that held water vital to its growth. And, long after you cut down a tree and dry its wood, those cells continue to exchange moisture. Under humid conditions, such as during the summer, these cells absorb moisture, swell, and cause a piece of wood to expand. As conditions dry, wood cells release moisture, shrink, and cause wood to contract in size.

Be aware: some woods

Although you will never come across a wood species that does not move, it pays to know what woods move the most and the least, and exactly how far they might move. To find out, we worked with experts at the U.S. Forest Service's Forest Products Laboratory to develop the charts on the *next two pages*.

Most wood movement that will affect your work will occur across the width of a workpiece. And, that amount will vary depending on whether your boards are flatsawn or quartersawn. As shown in the illustration *below*, you can



tell these boards apart by looking at the grain pattern on their ends and surfaces.

You don't need to be concerned about shrinkage or swelling along a board's length or thickness. That's because wood moves a negligible amount along its length, and boards less than 2" thick move little in that dimension as well.

In the chart we've listed the potential cross-grain movement for a 12"-wide workpiece. These figures apply to single workpieces, or multiple workpieces glued up for width. Of course, you can use these figures to calculate the potential movement for pieces wider or narrower than 12". Just divide the width of your workpiece by 12, then multiply that number times the figure in

for coping with MOVEMENT

move more than others

the right column of the chart. For example, say you make up a 26"-wide panel of black ash. Dividing 26 by 12 equals 2.166. By multiplying 2.166 times .250 (for flatsawn stock), you come up with the potential movement of your 26"-wide panel: .542".

Now, what can you do to deal successfully with this movement? Plenty, as you'll see from our list of strategies that starts here.

STRATEGY 1: Use the chart when you're building a project that requires relatively tight clearances between moving parts. When practical, choose from among those woods that move less than other varieties available to you.

STRATEGY 2: With the help of this information, decide how much allowance you must make for wood movement when planning your projects. In the example discussed earlier, the panel could move more than ½" from season to season. So, you have to allow the panel to shrink and swell about ⅝" across its width. (When you're in doubt about how far a workpiece will move, always err on the side of allowing more movement room than necessary.

Continued

POTENTIAL WOOD MOVEMENT SOFTWOODS

SPECIES	WIDTH (INCHES) AT HIGH HUMIDITY (WOOD AT 14% MOISTURE CONTENT)		WIDTH (INCHES) AT LOW HUMIDITY (WOOD AT 6% MOISTURE CONTENT)		WOOD MOVEMENT (INCHES) CAUSED BY 8% SWING IN MOISTURE CONTENT	
	QUARTERSAWN*	FLATSAWN**	QUARTERSAWN*	FLATSAWN**	QUARTERSAWN*	FLATSAWN**
BALD CYPRESS	12	12	11.88	11.80	.122	.198
CEDAR, ALASKA	12	12	11.91	11.81	.090	.192
CEDAR, ATLANTIC WHITE	12	12	11.91	11.83	.093	.173
CEDAR, EASTERN RED	12	12	11.90	11.85	.099	.150
CEDAR, INCENSE	12	12	11.89	11.83	.106	.166
CEDAR, NORTHERN WHITE	12	12	11.93	11.84	.070	.157
CEDAR, PORT ORFORD	12	12	11.85	11.78	.147	.221
CEDAR, WESTERN RED	12	12	11.92	11.84	.077	.160
DOUGLAS FIR, COAST TYPE***	12	12	11.85	11.76	.154	.243
DOUGLAS FIR, INTERIOR NORTH***	12	12	11.88	11.78	.122	.221
DOUGLAS FIR, INTERIOR WEST***	12	12	11.85	11.76	.154	.240
PINE, EASTERN WHITE	12	12	11.93	11.80	.067	.195
PINE, JACK	12	12	11.88	11.79	.118	.211
PINE, LOBLOLLY	12	12	11.85	11.76	.154	.237
PINE, LODGEPOLE	12	12	11.86	11.79	.138	.214
PINE, LONGLEAF	12	12	11.84	11.76	.163	.240
PINE, PITCH	12	12	11.87	11.77	.128	.227
PINE, POND	12	12	11.84	11.77	.163	.227
PINE, PONDEROSA	12	12	11.88	11.80	.125	.198
PINE, RED	12	12	11.88	11.77	.122	.230
PINE, SHORTLEAF	12	12	11.85	11.75	.147	.246
PINE, SLASH	12	12	11.83	11.76	.173	.243
PINE, SUGAR	12	12	11.91	11.82	.093	.179
PINE, VIRGINIA	12	12	11.87	11.77	.134	.230
PINE, WESTERN WHITE	12	12	11.87	11.76	.131	.237
REDWOOD, OLD GROWTH	12	12	11.92	11.86	.083	.141
REDWOOD, YOUNG GROWTH	12	12	11.93	11.84	.070	.157
SPRUCE, BLACK	12	12	11.87	11.78	.131	.218
SPRUCE, ENGELMANN	12	12	11.88	11.77	.122	.227
SPRUCE, RED	12	12	11.88	11.75	.122	.250
SPRUCE, SITKA	12	12	11.86	11.76	.138	.240

NOTES: * Quartersawn figures reflect radial movement (across growth rings).
** Flatsawn figures reflect tangential movement (parallel to growth rings).
For boards that are a mix of quartersawn and flatsawn, use flatsawn figures.
*** Coast Douglas fir is defined as Douglas-fir growing in the states of Oregon and Washington west of the summit of the Cascade Mountains. Interior West includes the state of California and all counties in Oregon and Washington east of but adjacent to the Cascade summit. Interior North includes the remainder of Oregon and Washington and the states of Idaho, Montana, and Wyoming.

WOOD MOVEMENT

POTENTIAL WOOD MOVEMENT HARDWOODS

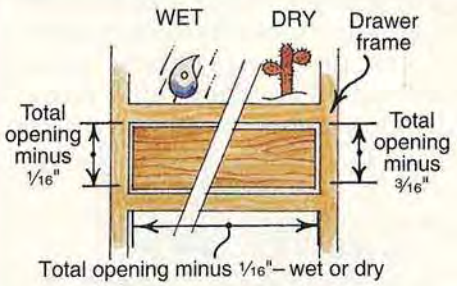
SPECIES	WIDTH (INCHES) AT HIGH HUMIDITY (WOOD AT 14% MOISTURE CONTENT)		WIDTH (INCHES) AT LOW HUMIDITY (WOOD AT 6% MOISTURE CONTENT)		WOOD MOVEMENT (INCHES) CAUSED BY 8% SWING IN MOISTURE CONTENT	
	QUARTERSAWN*	FLATSAWN**	QUARTERSAWN*	FLATSAWN**	QUARTERSAWN*	FLATSAWN**
ASH, BLACK	12	12	11.84	11.75	.160	.250
ASH, BLUE	12	12	11.88	11.79	.125	.208
ASH, GREEN	12	12	11.85	11.77	.147	.227
ASH, OREGON	12	12	11.87	11.74	.131	.259
ASH, PUMPKIN	12	12	11.88	11.80	.118	.202
ASH, WHITE	12	12	11.84	11.75	.157	.250
ASPEN, BIGTOOTH	12	12	11.89	11.75	.106	.253
ASPEN, QUAKING	12	12	11.89	11.79	.112	.214
BIRCH, ALASKA PAPER	12	12	11.79	11.68	.208	.317
BIRCH, GRAY	12	12	11.83	N/A	.166	N/A
BIRCH, PAPER	12	12	11.80	11.72	.202	.275
BIRCH, RIVER	12	12	11.85	11.71	.150	.294
BIRCH, SWEET	12	12	11.79	11.71	.208	.288
BIRCH, YELLOW	12	12	11.77	11.70	.234	.304
BUTTERNUT	12	12	11.89	11.80	.109	.205
CHERRY, BLACK	12	12	11.88	11.77	.118	.227
HICKORY, MOCKERNUT	12	12	11.75	11.65	.246	.352
HICKORY, PECAN	12	12	11.84	11.72	.157	.285
HICKORY, PIGNUT	12	12	11.77	11.63	.230	.368
HICKORY, SHAGBARK	12	12	11.78	11.66	.224	.336
HICKORY, SHELLBARK	12	12	11.76	11.60	.243	.403
MAHOGANY, HONDURAS	12	12	11.90	11.87	.096	.131
MAPLE, BIGLEAF	12	12	11.88	11.77	.118	.227
MAPLE, BLACK	12	12	11.85	11.70	.154	.298
MAPLE, RED	12	12	11.87	11.74	.128	.262
MAPLE, SILVER	12	12	11.90	11.77	.096	.230
MAPLE, STRIPED	12	12	11.90	11.72	.102	.275
MAPLE, SUGAR	12	12	11.85	11.68	.154	.317
RED OAK GROUP						
OAK, BLACK	12	12	11.86	11.64	.141	.355
OAK, LAUREL	12	12	11.87	11.68	.128	.317
OAK, NORTHERN RED	12	12	11.87	11.72	.128	.275
OAK, PIN	12	12	11.86	11.70	.138	.304
OAK, SCARLET	12	12	11.86	11.65	.141	.346
OAK, SOUTHERN RED	12	12	11.85	11.64	.150	.362
OAK, WATER	12	12	11.86	11.69	.141	.314
OAK, WILLOW	12	12	11.84	11.69	.160	.307
TEAK	12	12	11.92	11.81	.080	.186
WALNUT, BLACK	12	12	11.82	11.75	.176	.250
WHITE OAK GROUP						
OAK, BUR	12	12	11.86	11.72	.141	.282
OAK, CHESTNUT	12	12	11.83	11.65	.170	.346
OAK, LIVE	12	12	11.79	11.70	.211	.304
OAK, OVERCUP	12	12	11.83	11.59	.170	.406
OAK, POST	12	12	11.83	11.69	.173	.314
OAK, SWAMP CHESTNUT	12	12	11.83	11.65	.166	.346
OAK, WHITE	12	12	11.82	11.66	.179	.336

NOTES: * Quartersawn figures reflect radial movement (across growth rings).
** Flatsawn figures reflect tangential movement (parallel to growth rings).
For boards that are a mix of quartersawn and flatsawn, use flatsawn figures.

How the environment

As the seasons change, so will the dimensions of your wood. But, just as you survive the seasons by living in a temperature-controlled house, you can help your wood weather nature's ups and downs, too.

STRATEGY 4: Take delivery of your wood at least one week before you begin working with it. This gives it time to acclimate to your shop environment. If the wood is being delivered from another part of the country, where the humidity level may be



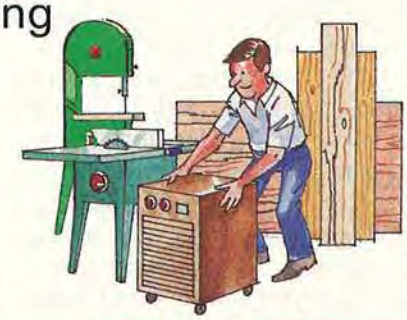
Pointers to keep in mind

It's a rare project that doesn't require some attention to the potential for wood movement. So keep the following strategies in mind no matter what you're working on.

STRATEGY 6: If a workpiece is warped, true it up by face- or edge-jointing before you rout, saw, or assemble it for your project. Don't attempt to force the board into flatness with clamps—the warpage will invariably show up in your finished project.

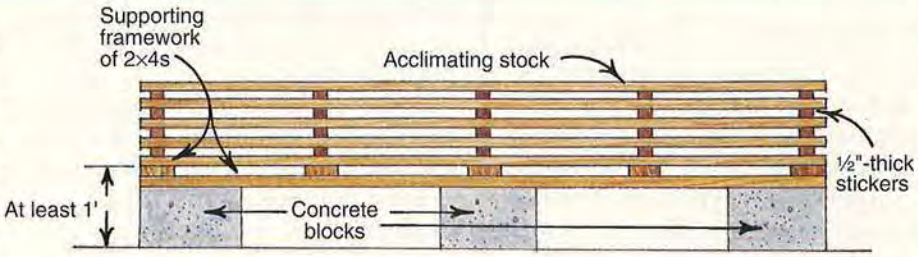
affects your woodworking

STRATEGY 3: As much as possible, control the temperature and humidity level in your shop and wood-storage area so they approximate the environment where your project ultimately will be located. Basement and garage shops in many areas



of the country typically require dehumidification in the summer and heating during the winter months. This will help minimize any wood movement that might occur after you move the project to its final destination in your home or elsewhere.

drastically different, give the wood a full month to acclimate. For the wood to adapt properly to its new surroundings you should store it at least 1' off the floor, with evenly spaced stickers that allow air to freely circulate as shown *right*.

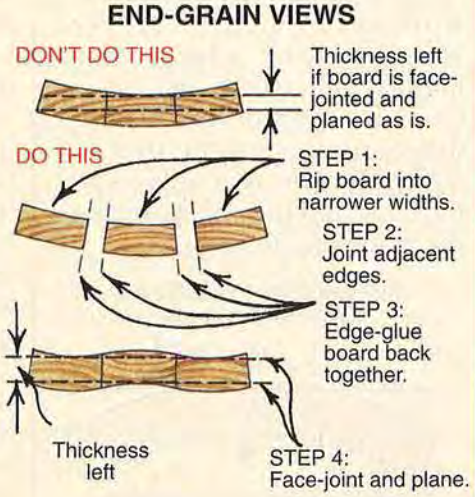


STRATEGY 5: If you're building a project under humid conditions, such as during the middle of summer, assume that the workpiece will probably not swell much more. So, in high-humidity conditions you can size frame-and-panel doors, and drawer fronts, so they're only about 1/16" smaller in width and length than their openings.

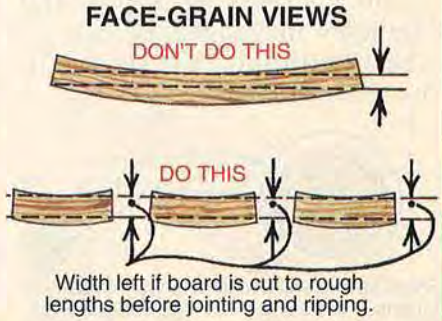
However, during the winter, when the air is typically as dry as it will get during the course of the year, you will have to plan for more clearance. Under these conditions, an average frame-and-panel cabinet door should be about 3/16" smaller in width and length than its opening (3/32" clearance all around). Likewise, a drawer front should be about 3/16" smaller across its width than its opening. Because it won't move along its length, you can make the drawer only 1/16" smaller in this dimension.

when building your projects

STRATEGY 7: Cupped or twisted boards can lose practically all of their thickness by the time you joint one face to flatten it, and thickness-plane the other face to flatten it as well. To preserve most of the thickness of such boards, rip them into two or three narrower pieces as shown in Step 1 *right*. Then, edge-joint these pieces and edge-glue them together into as flat a glue-up as possible. After the glue dries, face-joint and thickness-plane the glue-up. You'll come out with more usable stock.



STRATEGY 8: Severely bowed boards may require more drastic measures. If you come across a board seriously bowed along its length, cut the board into shorter lengths before jointing its edges. That will help you preserve the width of the workpieces.



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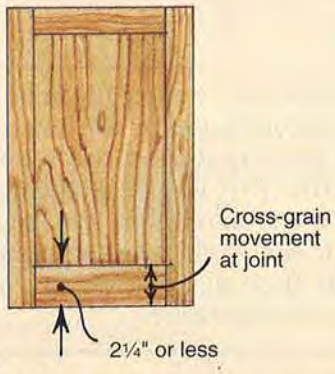
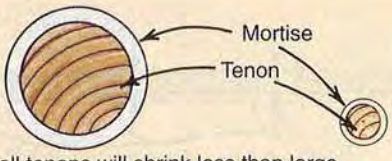
WOOD MOVEMENT



STRATEGY 9: Minimize the width of cross-grain workpieces, such as the rails in a rail-and-stile cabinet door. Because the grain in rails runs at 90° to the stiles, conventional wood-movement theory suggests that this joint would not hold up well. But, since the rails are typically less than 2¼" wide, their movement is slight enough that a joint glued and reinforced with dowels, biscuits, or pocket screws will not come apart.

Likewise, the pieces of a mitered picture frame will fight against each other under changing humidity levels. To prevent wood-movement problems, it's a good idea to keep these pieces no more than 3" wide.

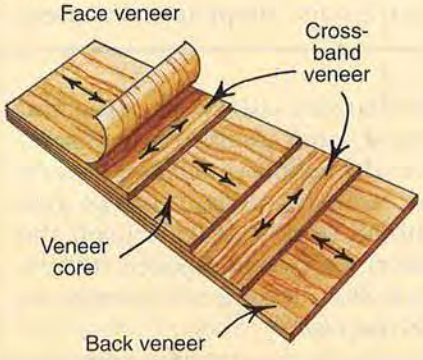
STRATEGY 10: It also pays to make the cross-grain dimension of tenons no larger than necessary. That's because the wider you make a rectangular tenon, or the larger in diameter you make a round tenon, the more that tenon will swell and shrink. And the more they move, the greater the likelihood that they will loosen over time.



Small tenons will shrink less than large tenons. (Amount of shrinkage exaggerated for clarity.)

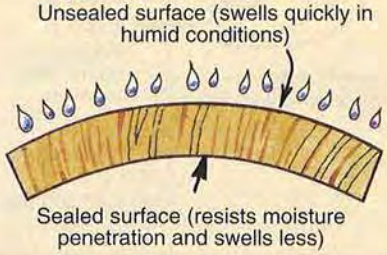
STRATEGY 11: Use plywood, melamine-coated particleboard, and other "engineered" wood products when you want to avoid wood-movement problems. These products are much less apt to move than solid wood because the veneers or chips that make them up run in opposing directions. So, if you simply don't have the time, skill, or inclination to make flexible joints, and plywood or particleboard will serve the purpose, use it!

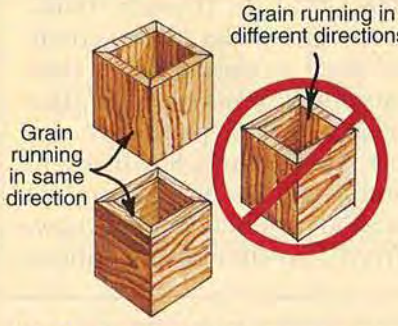
However, even if you prefer to work with only solid stock, you still should use plywood for your drawer bottoms. Why? When we build drawers, we like to use the bottom to square up the drawer. This requires that the bottom fit tightly into its grooves, leaving no room for expansion. By doing so, we also can glue the bottom into place knowing that the bond won't break. We've seen many drawer bottoms made of solid wood that have cracked or caused the sides of the drawer to push out and bind.



STRATEGY 12: When applying finish to your projects, always use the same finish—and the same number of coats—on all surfaces of the project parts. The finish helps prevent wood movement in two important ways. First, the finish helps prevent a sudden change in the moisture content of the wood by slowing down the gain or loss of water during sudden ups and downs in seasonal humidity.

And, coating both surfaces of a workpiece helps prevent warpage. How? A board that's finished on one side and not the other will gain or lose water at different rates on the two surfaces. Then, the two surfaces will move at different rates, causing the workpiece to warp.





STRATEGY 13: Always try to run the grain of your glued workpieces in the same direction. This way, the pieces will expand together, not in opposition.

For example, if you glue up a cutting board with grain running in different directions, workpieces swelling across their widths will be trapped by opposing pieces that do not swell along their lengths. Under these conditions, something has to give, and either the workpieces or the glue joints will split.

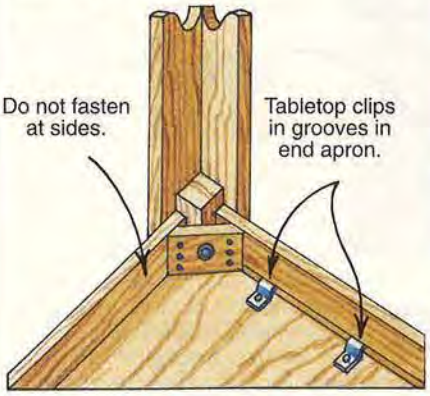
When you must join workpieces with opposing grain directions for aesthetic or functional reasons, you need to devise a flexible joint. (We'll share several examples later in this article.)

Specific problem areas and how to deal with them

By now, you should have a good general understanding of wood movement and how to deal with it. Here are some tips for handling especially tricky situations.

STRATEGY 14: Solid-wood tabletops can grow ½" or more across their width, so rigidly fastening such a top to its supporting apron can cause all sorts of problems. For example, if you attach a tabletop to its apron with screws only, one of three things probably will happen. Most likely the tabletop will split along its grain or a joint line, but it may bow upwards in its center. Or, the tabletop will force the apron to bow outward.

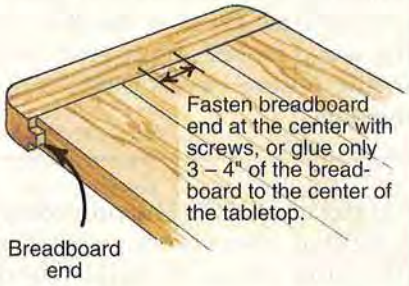
To prevent such mishaps, attach your tabletop with shop-made wooden clips, or commercially available steel versions like those shown *below*. The clips will hold the top down, and they also move with the wood and slide along grooves that you saw into the inside faces of the table aprons. Fasten the clips where the tabletop meets the supports that run perpendicular to the tabletop grain (the end aprons and center brace). Do not fasten the clips to the table where it meets apron pieces that run parallel to the grain.



STRATEGY 15: To help keep a solid-wood tabletop flat, while also hiding its end grain, you can add "breadboard ends" to the top. These consist of two boards, of the same species and thickness as the top, that have a tongue along one edge. The tongue goes into a groove that runs along the length of each end of the table.

The trick, of course, is fastening the breadboard ends to the table while allowing the table to move. To do this, machine the groove and tenon for a tight fit. Then, apply glue to just the center 3" or 4" of the tenon and groove, and press the breadboard end into position. The ends will stay in place and the tabletop will move on both sides of the glued area.

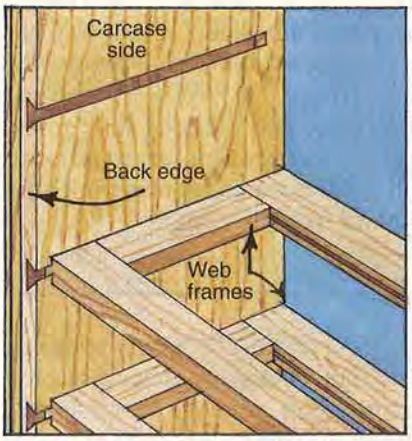
If you are making the breadboard ends during the humid summer months, cut them to the same length as the width of the tabletop. During dry periods, make the ends longer than the width of the table. How *much* longer depends on the species and width of the tabletop. See the charts near the beginning of this story for some assistance.



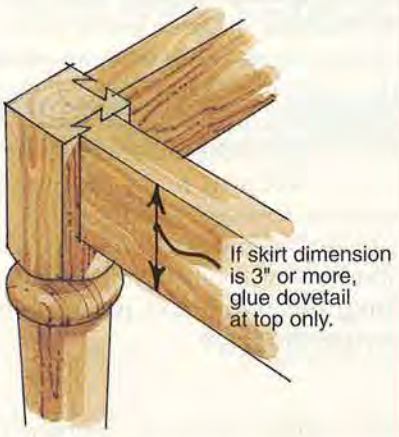
STRATEGY 16: With projects such as a chest of drawers that have web frames attached to solid-wood chest sides, the web frames cannot restrict the sides from moving. To accomplish this feat, you need to join the frames to the sides with sliding dovetail joints like those shown *right*.

Plan the web frames so they align flush with the front of the carcase. To do this, you will need to stop the dovetail grooves about ⅜" from the front of the sides. The dovetail tongues should stop ½" short of the front of the web frames.

To assemble the joint, apply glue to the front 3" of the dovetail groove only, and slide the web frame into position from the back of the carcase. There should be ⅜" of clearance between the frame and the carcase back.



STRATEGY 17: A sliding dovetail joint also works well for joining table skirts to legs. See the drawing *right*.



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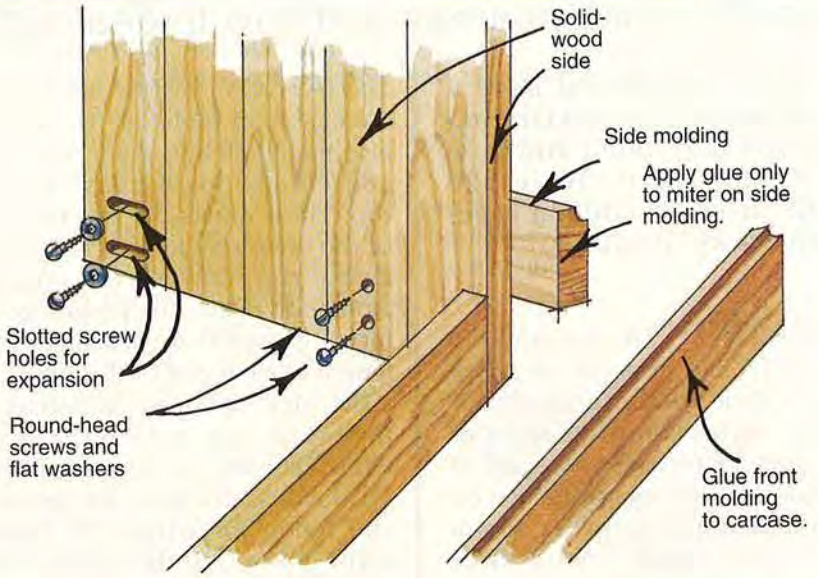
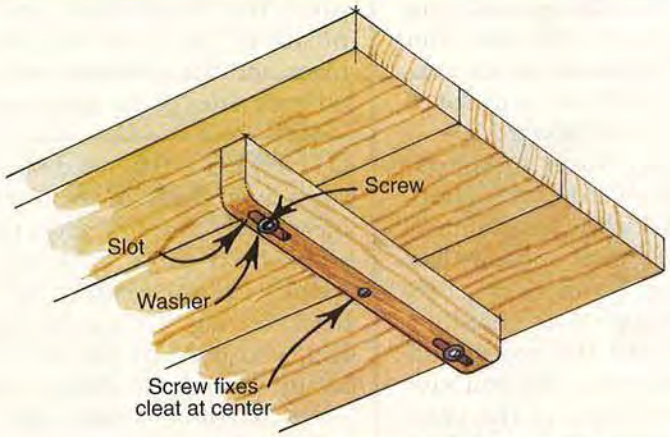
WOOD MOVEMENT

STRATEGY 18: Just as you need to make allowance for solid-wood sides to move against internal frames as described in *Strategy 16*, you also need to make provisions for the sides to move against external attachments such as moldings. To do this, rout ½"-long slots into the side, behind the position where the moldings will be applied. Then, glue the front molding to the carcase, and attach the side moldings with screws and washers that slide freely in the slots as the wood moves. Apply glue only to the mitered ends of the side moldings.

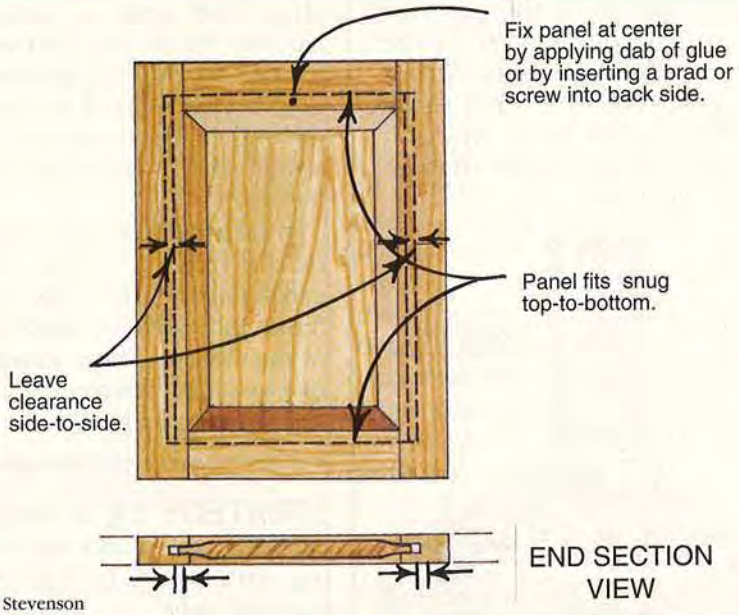


STRATEGY 19: The procedure described *above* also works for attaching cleats to solid-wood panels such as a tabletop or chest lid. These cleats help reinforce the panel and keep it flat. Similar to the breadboard end described in *Strategy 15*, you can permanently fix the cleat at its center with a screw. This arrangement still allows the panel to shrink and expand from its center.



STRATEGY 20: When planning the size of panels that fit within frames you need to keep several things in mind. First, allow room for solid-wood panels to expand widthwise. (Again, refer to the charts for an idea of how much the panel will expand.) Panels won't expand lengthwise, so fit them tight in this dimension.

Also, keep in mind the points made in *Strategy 5* about humidity and dry weather. You'll need to allow extra room if you're assembling the frame and panel under dry conditions.



Written by Bill Krier with Jan Svec Illustrations: Kim Downing; Jim Stevenson

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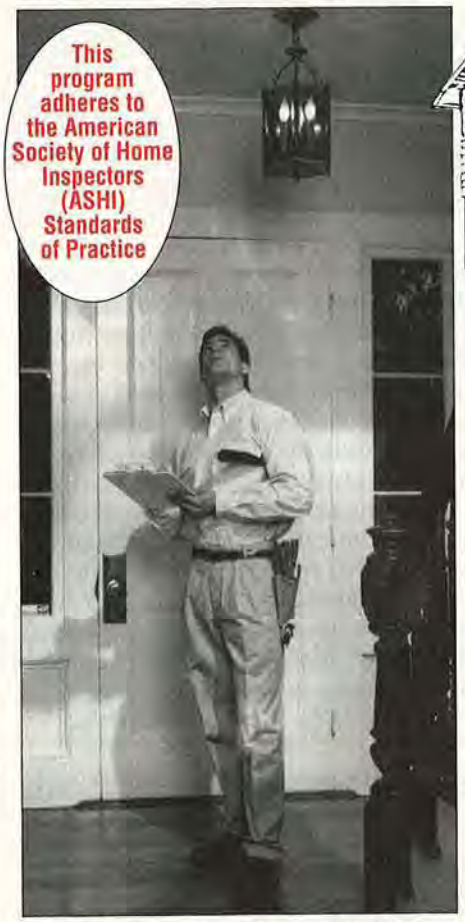

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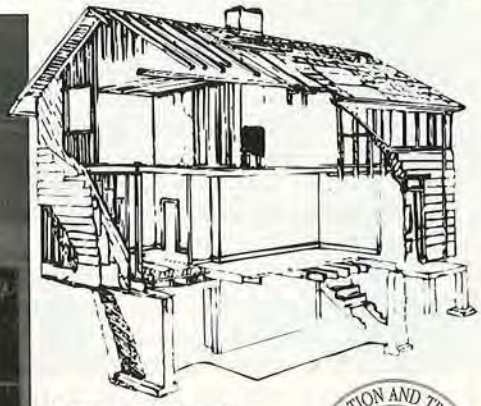

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Carbide-tipped Forstner bits cut smooth and clean

Just about any new Forstner bit will cut reasonably well. But their steel cutting edges become dull over time. And once they're dull, Forstner bits tend to burn the edges of the hole and require a lot of feed pressure.

Freud's new Forstner bits address these problems with two carbide-tipped cutting edges. The carbide is brazed to the body of the bit just like the carbide tips of a router bit. The seven-piece set I tested includes bits with diameters of ¼, ⅜, ½, ⅝, ¾, 1, and 1⅜".

Right out of the box, these bits were well sharpened. And, when I first ran them through test samples of oak, maple, and pine, the carbide cut into the wood with surprising ease. In my estimation, the feed pressure required by the Freud bits was half of that of most other new Forstner bits.

I also came away impressed by the quality of the hole these bits produce. Freud grinds a small scoring tip on the outer edge of the carbide. This severs the wood fibers much like a knife edge just before the remainder of the edge and the carbide cutters enter the wood. The result is a crisp, clean entry hole with no tear-out, even in difficult wood like oak.

Another plus for carbide is that it stands up well to particleboard and plywood. The glue in these products quickly dulls steel edges, but the carbide slices through this material repeatedly with little loss of sharpness. The carbide also holds up well to hard synthetic materials such as plastic laminates and solid-surface materials.

PRODUCT SCORECARD

Freud Carbide-Tipped Forstner Bits

Performance	★ ★ ★ ★ ★
Price	Seven-piece set: about $90
Value	★ ★ ★ ★ ★

Freud Inc., P.O. Box 7187, High Point, NC 27264. Call 800/472-7307.

Freud offers 16 different bits in ⅛" increments from ¼" to 2⅛" in diameter. And the prices are competitive with many high-speed steel Forstner bits, making these carbide-tipped newcomers a terrific value in my estimation.

—Tested by Bob McFarlin

Spring-loaded clamp zips closed automatically

I can't begin to count the number of times I wished I had a third hand or a helper to hold an assembly while I position a clamp. The new Quick-Star clamp from Gross Stabil solves that problem with a spring-loaded jaw that automatically slides forward when it's released.

The clamp has a U-shaped aluminum bar, with a flat coil spring attached to the sliding jaw. To use the clamp, you pull the sliding jaw back, hold it in place with your thumb, position the clamp, and then release the jaw. The sliding jaw zips forward and holds tight enough to support its own weight. You then turn the handle to exert the proper clamping pressure with the 3½"-deep jaws. When you're not using the clamp, a molded end cap provides an easy way to hang it on a nail or hook.

PRODUCT SCORECARD

Quick-Star clamps

Performance	★ ★ ★ ★ ☆
Price	8": about $24, 12": about $28
Value	★ ★ ★ ★ ☆

Gross Stabil Corporation, 333 Race St., Coldwater, MI 49036. Call 800/671-0838 or 517/278-6121.

You can get the same one-handed efficiency from products like Quik-Grip Bar Clamps and E-Z Hold Bar Clamps, but the Quick-Star clamp gives you the edge in speed. Not having to repeatedly squeeze a pistol-style grip comes in handy when you're stretched out, clamping overhead, or in some other awkward position. The only difficulty I experienced was that sometimes the jaws, when fully closed, become difficult to separate and require a sharp rap on the sliding jaw to open.

—Tested by Dave Henderson

Print this article

Drill-press-mounted oscillating spindle sander

You can't beat oscillating spindle sanders for their ability to smooth the edges of curved workpieces. Delta's Oscillating Spindle Sander Attachment for drill presses gives you the same sanding action at a lower price and without taking up much room in your shop.

The attachment is driven by a belt wrapped around the chuck of the drill press. The belt turns a right-angle worm-and-screw gear assembly that creates the up-and-down oscillating action.

Installation and removal of the attachment is simple and straightforward, but you don't have to remove the attachment to resume drilling operations (just slip off the belt).

In operation, the device traveled smoothly throughout its ¾" oscillating range. An added advantage over dedicated oscillating spindle sanders is that the oscillating speed of this attachment increases as you increase the spindle speed of the chuck. Spindle speeds from 1,700 to 2,300 rpm produce from 30 to 50 strokes per minute, providing an ideal ratio at any spindle speed.

The attachment comes with an 8½×8½" table and dust-collection assembly that bolts to your drill-press table. The table accepts sanding drums up to 3" in diameter, and the dust-collection port accepts 2½"-diameter hoses for shop vacuums.

I found the small table size inconvenient for sanding large pieces, but Delta includes plans with the attachment for building your own auxiliary work surface.

—Tested by Dave Henderson

Continued on page 82

PRODUCT SCORECARD

Delta Oscillating Spindle Sander Attachment

Performance	★ ★ ★ ★ ☆
Price	About $80
Value	★ ★ ★ ★ ★

Delta International Machinery Corp., 246 Alpha Dr., Pittsburgh, PA 15238. Call 800/438-2486.

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Continued from page 81

Biscuit joiner includes all the right features

Unlike many manufacturers, Makita made a relatively late entry into the biscuit-joiner market. But its model 3901 Plate Joiner (some manufacturers prefer "plate" instead of "biscuit") shows that the company did its homework well, especially when it came to building the fence.

A rack-and-pinion elevation gear keeps the fence parallel to the blade. I measured it for deflection after locking and never detected more than .003-004" error, which is excellent. This aluminum fence is adjustable from 0° to 90°, with positive stops at 0°, 45°, and 90°. Since the fence tilts downward, you can capture a beveled edge. Large, comfortable levers lock and unlock the fence for setting angles or adjusting the height of the cut.

In use, the 5.6-amp motor delivers plenty of power. The motor housing and 4" carbide-tipped blade slide forward smoothly on two steel rods. On the faceplate, a rubber pad prevents slippage. The 3901's dust-collection bag keeps work surfaces clear of chips and dust, which could interfere with alignment and achieving an accurate cut.

The depth-of-cut limiter works like the stop on a plunge router, and gives you six settings just by turning a barrel. Maximum depth of cut measures $^{25}/_{32}$".

The only thing I don't like about this plate joiner is the switch setup. To lock it in the "on" position, you push it forward until it clicks into place. To turn the machine off, you have to release the catch and then move your thumb out of the way quickly to permit the switch to slide back. This made it difficult to get the switch to kick into the "off" position. I'd like to see Makita bring this component up to the top-notch standards found throughout the rest of the machine.

—Tested by Bob McFarlin

Continued on page 99

PRODUCT SCORECARD

Makita model 3901 Plate Joiner

Performance	★ ★ ★ ★ ☆
Price	about $210
Value	★ ★ ★ ★ ★

Makita, 14930 Northam St., La Mirada, CA 90638. Call 714/522-8088.

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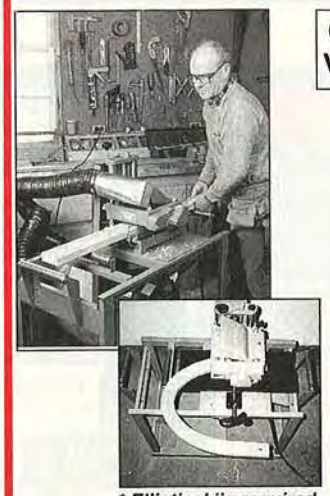

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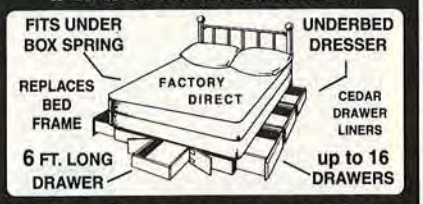

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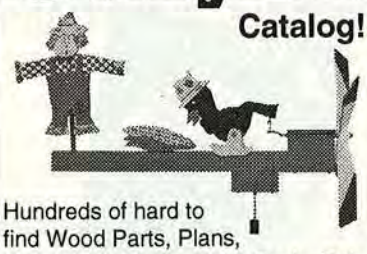

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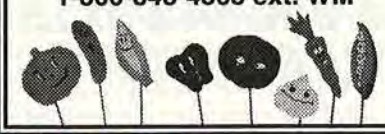

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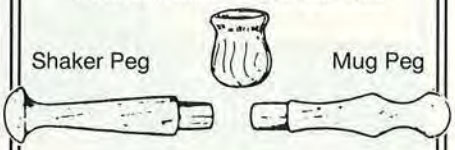

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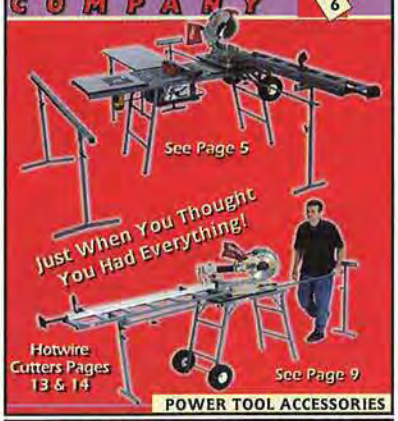

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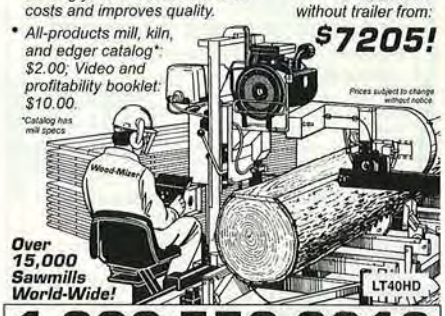

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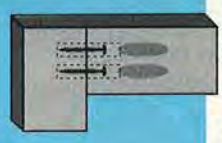

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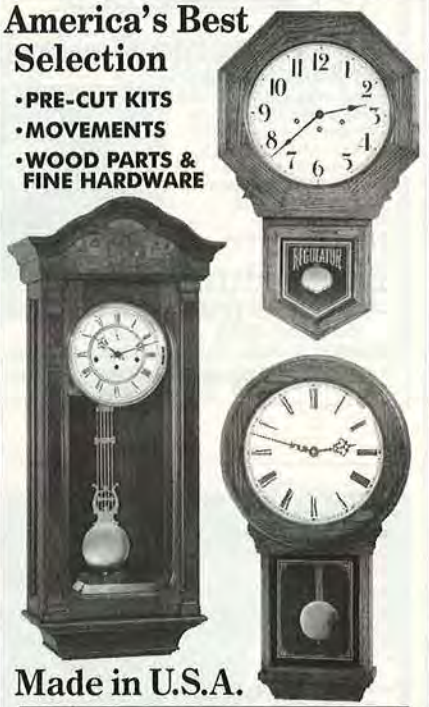

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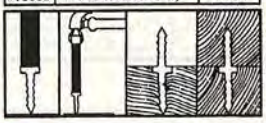

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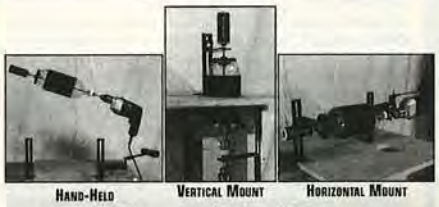

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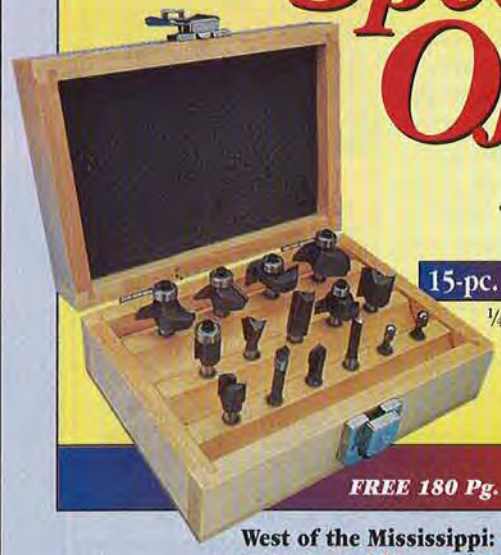

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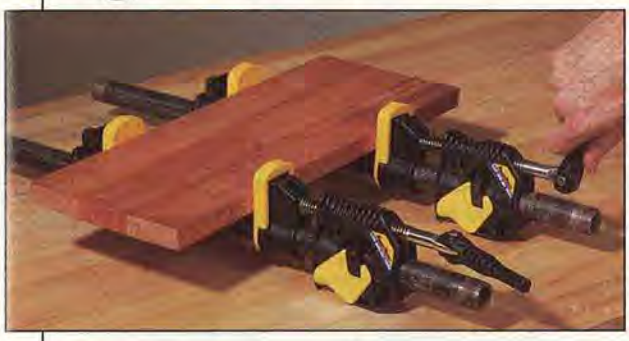
Circle No. 860

Continued from page 82

New pipe clamps improve on an old standard

Traditional pipe clamps don't cost much, and they work well for edge-to-edge glue-ups. The new Power Press Pipe Clamps, however, offer several useful refinements and innovations compared to traditional models.

To start, the Power Press clamps don't require pipe with threaded ends. You can slide the clamping head anywhere along the length of a piece of ¾" black pipe. This works great when you have a small workpiece to clamp and only long lengths of pipe. You can position the workpiece and the clamps in the middle of the pipe and not have an unbalanced row of pipes dangling off your bench. You also can reverse the movable clamping head in just seconds for use as a spreader clamp.



I also liked the pivoting crank handles that turn the screw. With these you can quickly position the clamp on a workpiece, then rotate the handle for maximum clamping leverage.

The Power Press clamps come with padded clamping surfaces so you don't have to buy or build pads. And they'll stand up on their own to give you a solid platform on which to lay workpieces. Most of the components are made from plastic, which raised some doubts in my mind about the durability of these clamps. But I banged them around plenty and found no evidence of cracking or chipping.

Traditional pipe clamps cost about half of what you'll pay for Power Press clamps. So I wouldn't outfit a whole shop with these new clamps. But given the many convenient features, I'd say most woodworkers would benefit from owning at least a few.

—Tested by Dave Henderson

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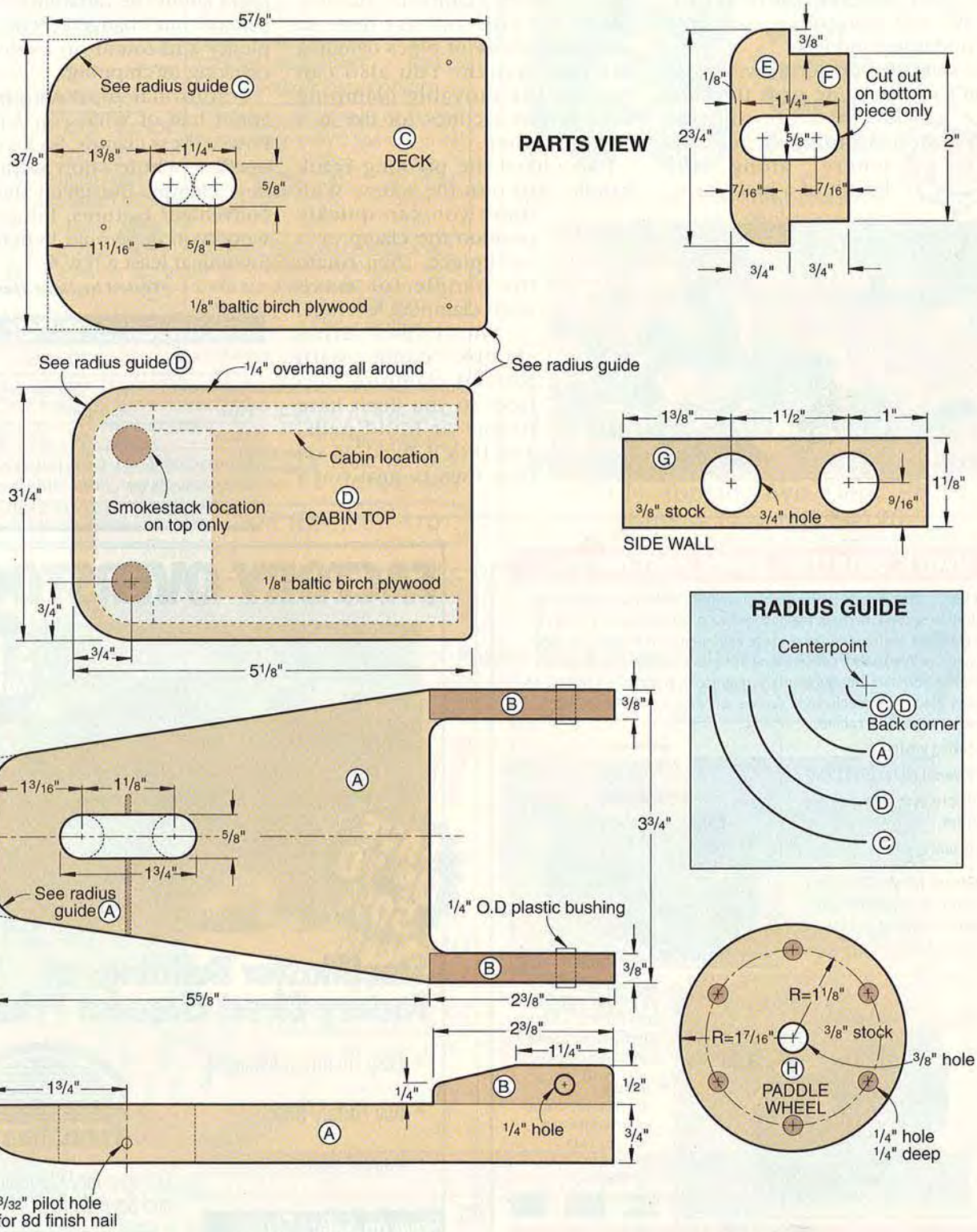
Continued from page 67



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DELTA TOOLS

Model	Description	List	Sale
31-695	6" Belt/9" Disc Sander	441	330
23-700	Wet/Dry Grinder	206	159
23-710	New Sharpening Center	217	169
23-680	6" Bench Grinder 1/4 HP	80	69
11-950	8" Drill Press	176	128
31-050	1" Belt sander 2.0 amp	95	78
31-460	4" Belt/Disc Sander	198	129
40-560	16" 2 speed Scroll Saw	230	175
11-990	12" Bench Drill Press	255	184
11-090	32" Radial Bench Drill Press	405	315
43-505	1/2" Bench Router/Shaper	398	305
22-540	12" Bench Top Planer	Sale	385
36-220	10" Compound Mitre Saw	294	219
28-185	Bench Band Saw	213	185
28-190	NEW 12" Band Saw	497	399
40-640	20" Bench Scroll Saw	466	295
37-070	NEW 6" v/spd Bench Jointer	351	259
14-650	Hollow Chisel Mortiser	380	275
46-700	12" Wood Lathe	575	479
33-990	10" Radial Arm Saw	981	769
33-055	8-1/4" Sawbuck comp w/legs	846	665
36-040	8-1/4" Compound Mitre Saw	190	149
36-905	30" Unifence	346	249
36-906	50" Delta Unifence	444	305
36-755	10" Tilting Arbor Saw	Sale	1095
17-900	16-1/2" Floor Drill Press	490	415
33-060	"Sidekick" Miter Saw	541	399
37-190	6" Deluxe Jointer	603	499
36-275	8-1/4" Builders Saw	358	268
36-210	10" Compound Mitre Saw	344	249
36-070	10" Mitre Saw	217	165
34-555	Sliding Table	487	289
22-675	NEW DC380 15" Planer	Sale	1175
37-154	6" Jointer DJ-15	Sale	1299
34-444	Contractors Table Saw	Sale	649
34-445	34-444 Saw w/30" Unifence	Sale	839
28-283	14" Band Saw 3/4 HP motor	Sale	779
28-280V	14" Band Saw 1 HP motor	Sale	798
28-275	14" Band Saw 3/4 HP	Sale	659
36-250	NEW 10" Slide Compound Saw	825	489
36-230	NEW 12" Compound Mitre Saw	480	359
31-780	NEW Oscillating Spindle Sander	253	188

MILWAUKEE TOOLS

6527	NEW Sawzall with case	343	178
6528	above Sawzall w/wired cord	339	178
0408-6	12V Drill w/kyls chuck&2 batt	380	172
0406-1	9.6V Drill Kit with 2 batteries	315	155
0224-1	3/8" Drill 4.5 amp magnum	236	132
0234-1	1/2" Drill 4.5A mag 0-850 rpm	255	142
0235-1	1/2" Drill w/keyless chuck	255	142
0244-1	1/2" Drill 4.5A mag 0-600 rpm	255	142
0222-1	3/8" Drill 3.5 amp 0-1000 rpm	213	119
0228-1	3/8" Drill 3.5 amp 0-1000 rpm	207	118
0375-1	3/8" close quarter Drill	255	148
0379-1	1/2" close quarter Drill	288	165
6546-1	cdls Screwdvr 200 & 400 rpm	150	84
6547-1	6546-1 w/bits,1/4" chuck & cs	185	105
5399	1/2" D-hdle Hammer Drill Kit	356	194
6507	Original SawZall with case	278	155
5397-1	3.8" v/spd Hammer Drill Kit	275	149
5371-1	1/2" v/ spd Hammer Drill Kit	360	194
3107-1	1/2" v/spd right angle Drill Kit	411	234
3300-1	1/2" v/ spd right angle Drill	378	219
5680	Router 2 HP w/ 1/4" & 1/2" collets	367	165
6142	4-1/2" Grinder w/cse & acc	224	125
6365	7-1/4" Circular Saw 13 amp	229	125
6368	6365 w/fence, blde,& cse	259	142
6256	Top Handle Jig Saw	278	158
6490	10" Mitre Saw	496	265
6491	6490 w/ carbide blade & bag	594	329
6494	10" Compound Mitre Saw	585	325
0431-1	12V Drill w/ 2 batteries	441	229
6266-6	NEW Top Handle Jig Saw	315	165
6496	NEW 10" Slide Compound Saw	1050	579

FREUD CARBIDE TIPPED SAW BLADES
5/8" Bore - Industrial Grade

Item	Description	Teeth	List	Sale
LU72M010	Gen Pur. A.T.B. 10"	40	69	42
LU82M010	Cut-off 10"	60	93	45
LU84M011	Comb 10"	50	78	42
LU85M010	Super Cut-off10"	80	115	59
LM72M010	Ripping 10"	24	69	38
LU73M010	Cut off 10"	60	84	45
LU87M010	Thin Kerf 10"	24	72	44
LU88M010	Thin Kerf 10"	60	88	49
LU98M010	Ultimate 10"	80	128	68
LU91M010	Compnd Mitre 10"	60	88	54
F410	Quiet Blade 10"	40	95	49
F810	Quiet Blade 10"	80	135	74
TK303	7-1/4" Finishing	40	38	25
TK905	10" Combo	50	53	32
SD308	8" Dado - Carbide		230	119
SD506	6" carbide w/case & shims		292	155
SD508	8" carbide w/case & shims		344	168
F10	2-1/8" x 3/4" Biscuit 1000 qty		43	29
F20	2-3/4" x 1" Biscuit 1000 qty		45	29
FA	Assorted Biscuits 1000 qty		45	29
FB100	16 piece Forstner Bit Set		338	194
94-100	5 pc. Router Bit Door System		320	169
BF3	NEW Router Table		495	289
FT2000E	3-1/4 HP v/sp Plunge Router		410	205
JS100	Biscuit Jointer w/ case		334	168
JS102	Biscuit Jointer w/fence & cs		355	179

$50.00 REBATE
TR215 8-1/2" Slide Cmpd Mitre Saw
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WAP VACUUMS

Model	Description	List	Sale
766RDF	10 gallon turbo vacuum	845	465
766RDF-D	"Drywaller" 10 gal turbo vacuum	915	549
766RDF-DAS	Above vac w/ auto start	950	589

MAKITA TOOLS

6172DWE	3/8" v/spd Drill Kit w/ 2 batt	222	109
5090DW	3-3/8" Saw Kit 9.6 volt	280	148
DA391D	3/8 angle Drill 9.6V	166	109
DA391DW	3/8" angle Drill Kit 9.6V	341	179
ML900	Incandescent Flashlight 9.6V.		37
6095DWE	9.6 volt Drill Kit w/2 batt	Sale	139
6095DWLE2	6095DWE w/flashlight	Sale	145
6095D	6095DW Drill only & cse	Special	79
632007-4	9.6 volt Battery	47	30
632002-4	7.2 volt Battery	39	28

NEW CORDLESS DRILLS WITH HIGH CAPACITY BATTERIES

6201DWHE	9.6V 3/8" Drill Kit w/2 batt	351	159
6211DWHE	12V 3/8" Drill Kit w/2 batt	368	185
6311DWHE	12V 1/2" Drill Kit w/2 batt	399	205

SUPER CORDLESS SPECIALS

6073DW	7.2V cdls Drill Kit. Variable speed & clutch. Complete with battery, charger, & case.	Super Sale	99
T220DW	9.6 volt Stapler Kit. Complete with battery, charger, & case	Super Sale	99
9900B	3"x21" Belt Sander w/bag	347	179
9924DB	3"x24" Belt Sander w/bag	360	189
4301BV	Orb. var. spd Jig Saw 3.5A	292	155
JR3000V	v/ spd Recip Saw w/case	264	139
9820-2	Blade Sharpener	433	215
N1900B	3-1/4" Planer with case	263	132
1912B	4-3/8" Planer	352	189
N9514B	4" Disc Grinder 4.6 amp	118	65
B04552	1/4 sheet Pad Sander w/bag	101	55
DA3000R	3/8" Angle Drill	355	175
2708W	8-1/4" Table Saw	637	309
6405	3/8" Drill Rev. 0-2100 rpm	115	65
6510LVR	3/8" Drill Rev. 0-1050 rpm	188	98
6013BR	1/2" Drill Rev. 6 amp	270	145
9401	4" x 24" Belt Sander w/bag	458	219
5007NB	7-1/4" Circular Saw 13 amp	242	124
5007NBK	5007NB Saw w/ plastic cse	250	129
LS1011	10" Slide Compound Saw	995	479
LS1211	12" Slide Cmpd Saw	1620	789
3901	Plate Joiner Kit	376	205

SENCO AIR NAILERS

SFN1+	Finishing Nailer 1" - 2" w/ cs	448	345
SN325	Nailer 1-7/8" - 3-1/4"	665	419
SLP20	New Pinner w/cs 5/8 -1-5/8"	422	278
SKS	Stapler 5/8" - 1-1/2"	390	285
SN70	Framing -Clip Hd 2"-3-1/2"	725	459
SN60	Framing -Full Hd 2"-3-1/2"	708	469
SN65	15% more power than SN60	709	479
SFN40	Finish Nailer 1-1/4 - 2-1/2"	569	399

BOSTITCH AIR NAILERS

N80S-1	Stick Nailer	Super Sale	339
RN45	Coil Roof Nailer 3/4 - 1-3/4	845	369
N60FN-2	Finishing Nailer	557	335
BT35-2	Brad Tacker 5/8" - 1-3/8"	254	155
BT35-2K	BT35-2 w/ cse, oil, & brads	279	165
CWC100	1 HP Pancake Compressor	440	289
MIIIFS	Flooring Stapler 15 gauge	902	529
S32SX-1	Finish Stapler-1/2" - 1-3/8"	245	155
S32SX-1K	S32SX-1 with case & oil	269	165

SKIL TOOLS

2735-04	12 volt cordless Drill Kit	260	148
2736-04	2735-04 with keyless chuck	269	148
77	Famous 7-1/4" Worm Drive Saw	Sale	144
77M	NEW 77 Mag Worm Saw - 2 lbs lighter than Model 77	Sale	165

PANASONIC CORDLESS

EY6181CRKW	9.6V Drill Kit w/ 2 batteries, 1 hour charger, & case	307	169
EY6181EQK	9.6 volt Drill with 15 min. charger, case & Ironman battery	315	175
EY6100CRKW	12 volt Drill Kit w/ 2 batteries, 1 hour charger, & case	379	188
EY6100CQKW	Same as EY6100CRKW but has 15 minute charger	409	209
EY6100EQKW	12V Drill kit w/ 2 Ironman batteries, 15 min. charger, & case	379	199
EY6101SQK	12 volt 1/2" Drill w/ 15 min. charger, diagnostic battery, & case	438	249

PASLODE IMPULSE GUNS

IM250	Trimpulse Finish Nailer Kit.	1130	548
IM325	Impulse Framing Nailer Kit	1130	548

CLAYTON OSCILLATING SPINDLE SANDERS

140	Portable sndr w/ 4-1/2" spindle	625	559
146	Portable sander w/ 9" spindle	685	609
100	Floor mount sndr 4-1/2" spindle	785	709
106	Floor mount sander 9" spindle.	845	759

SIOUX TOOLS

8030	3/8" var/spd Drill	263	145
8000	3/8" var/spd close qtr Drill	211	125
690	5" Air Random Orbit Sander	228	132

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Model	Description	List	Sale
DW364	7-1/4" Circ. Saw w/brake	294	158
DW610	1-1/2 HP 2 handle Router	266	152
DW411	1/4 sheet Palm Sander	88	58
DW100	3/8" Drill, 4 amp,0-2500 rpm	118	68
DW682K	Biscuit Joiner with case	448	219
DW705	12" Compound Mitre Saw	734	359
DW625	3 HP w/ spd PlungeRouter.	Sale	275
DW675K	3-1/8" Planer with case	292	164
DW431	3 x 21 v/spd Belt Sander	338	184
DW421	5" Palm Ran. Orb Sander	144	79
DW444	6" Ran Orb Sander	266	139
DW443	DW444 w/hook & loop pad.	266	139
DW673K	NEW Laminate Trimmer Kit	364	215
DW935K	NEW 14.4V 5-3/8" Trim Saw Kit	444	237

DW935K comes with two batteries!

DEWALT CORDLESS DRILLS

DW952K	3/8" variable speed w/ two 9.6V XR batteries	284	139
DW962K-2	3/8" variable speed w/ two 9.6V XR batteries	330	179
DW972K-2	3/8" variable speed w/ two 12V XR batteries	362	189
DW904	12 volt flashlight	48	29.95
DW972K-2 drill & DW904 flashlight		*Sale*	*205*
DW991K	3/8"variable speed w/ one 14.4V XR battery	388	199
DW991K-2	above drill w/ 2 batteries	Sale	225
DW994KQ	1/2" variable speed w/ one 14.4V XR batteries	458	235
DW994KQ-2	above drill w/ 2 batt.	Sale	259

Above drill kits come w/ charger & steel case!

DW991KS-2	DW991K drill, DW935 trim saw, & case	Sale	349

HITACHI TOOLS

C8FB2	8-1/2" Slide Compound Saw	1169	489
C10FC	10" Mitre Saw	533	209
C10FS	10" Slide Compound Saw	1627	739
P12R	12-9/32" Planer	1688	795
P12RA	Planer/Joiner	2203	995
G12SA	4-1/2" Grinder 6.9 amp	177	79
NR83A	Framing Nailer 2 - 3-1/2 Full Head	900	399
NR83AA	Framing Nailer 2 - 3-1/2	922	425
NT65A	16 ga. Brad Nailer 1 - 2-1/2	749	345
NV45AB	Coil Roofing Nailer 7/8 - 1-3/4	935	399
EC6B	1 HP Oil Compressor	540	279
EC6C	1 HP Oil-less Compressor	580	289

BIESEMEYER FENCES

B-50	50" Commer. Saw	443	329
T-SQUARE 52	52" Homeshop	360	269
T-SQUARE 40	40" Homeshop	335	249
T-SQUARE 28	28" Homeshop	325	239

PONY CLAMP FIXTURES

Model	Description	List	Sale	Lots of 12
50	3/4" Black Pipe	15.45	8.10	92.50
52	1/2" Black Pipe	12.65	6.95	74.95

BOSCH

Model	Description	List	Sale
1587VS	Top Hand "CLIC" Jig Saw	292	139
1584VS	Barrel"CLIC" Jig Saw	288	139
	Bosch Metal Case for above Jig Saws		32
	Bosch 30 blade assortment for Jig Saws		28.99

1584VS or 1587VS
with steel case and 30 Bosch blades Sale 185

3270DVS	3"x21" v/spd Belt Sander	301	165
1276D	NEW 4"x24" Belt Sander	379	219
1275DVS	NEW 3"x24" v/s Belt Sndr	379	219
1276DVS	NEW 4"x24" v/s Belt Sndr	408	229
1347AK	4-1/2" Grinder w/cs & acc	172	105
1194VSR	1/2" v/ spd Hammer Drill	272	155
1194VSRK	above Drill w/ case	303	169
1604A	1-3/4 HP 2 Handle Router	269	142
1604AK	same as above w/cse & acc	337	185
1613EVS	2HP v/s Plunge Router	369	199
1615EVS	3 HP v/s Plunge Router	536	298

1613EVS & 1615EVS come with FREE RA1051 Deluxe Router Guide !

1634VSK	NEW Recip Saw 10.5 amp	335	159
3310K	NEW 12V T-handle Drill Kit	345	189
3107DVS	NEW 5" Random Orbit Sander	165	98
3107DVSK	3107DVS with case	195	115
3725DVS	NEW 5" Random Orbit Sander	256	149
3727DVS	NEW 6" Random Orbit Sander	266	154
B3915	NEW 10" Slide Compund Saw	1050	619
B1650K	Biscuit Joiner	286	169
B7000	Corner Detail Sander	126	68
B7001	B7000 w/ variable speed	Sale	89.95
B4050	In Line Jig Saw	206	119
11230EVS	SDS-max 1-1/2" Rtry Hmr	910	539
11231EVS	SDS-max 1-3/4" Rotary Hammer	1363	815
11223EVS	NEW SDS-max 2" Rotary Hammer	1595	945
11224VSR	7/8" SDS Rotary Drill	404	229

AIRY AIR NAILERS

Model	Description	List	Sale
0241SK	Brad Nailer 3/8"-1 9/16"	180	95
0250SK	Brad Nailer 3/4"-2"	296	164
0626SK	1/4" Crown Stapler 3/8"-1"	194	104
0645	1/4" Crown Stapler 3/4"-1-9/16"	310	175
EZ-1	Multi-purpose nailer & stapler	18098	

Above Nailers come w/case, fasteners, oil & wrenches

0565T	Angle Finish Nailer 1"-2-1/2"	386	205

PORTA NAILER

401	Porta Nailer complete	295	209
501	Face Nailer complete	295	209

DAVID WHITE

LP6-20	Sight Level package - 20x	329	215
LP6-20XL	LP6-20 w/9056 tripod & 7620 rod	275	
LT8-300	Level Transit - 26x	739	489
LT8-300P	above Level w/optical plum	869	565
LT6-900	Level Transit - 20x	419	269
ALT6-900	Automatic Level - Transit -18x	666	429
ALTP6-900	above Level w/tripod & rod	799	499
ALP6-18HD	above Level w/tripod & rod	599	395
LL100	NEW Finish Line Laser Level	199	135

RYOBI SPECIALS

RE600	3 HP Plunge Router	500	228
BE321	3"x21" v/ spd Belt Sander	310	148
BT3000	10" Table Saw w/ stand	1125	529
AP12	12" Bench Planer	884	389
OSS450	Oscillating Spindle Sander	340	159
DC500	Detail Carver	120	64
HT20VSK	NEW Multi Tool	115	59
CD125K	NEW 12V cordless Drill w/ 2 batt	175	109
Msxe6362	FEIN Triangle Sander w/spd		205
Msx625	FEIN New Air Triangle Sander		189
LPN672	PONY Air Palm Nailer w/glove		94.99
RTM01	ROTOZIP Drywall cut out unit		69.95

QUAL-CRAFT PRODUCTS

2200	Pump Jack	79	58
2201	Pump Jack Brace	30	20
2203	Pump Jack guard rail holder	31	23
2204	Workbench & rail holder combo	53	39

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2601	Wall Jack	167	108

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PORTER CABLE

9444	New Profile Sander Kit	220	119
7499	Ultimate Cut-out tool	119	69
97499	7499 w/ case & bits	150	89
690	1-1/2 HP Router 8 amp	276	142
9690	690 Router w/ steel case	309	159
691	1-1/2 HP Router D-handle	303	158
693	1-1/2 HP Plunge Router Base	338	184
6931	Plunge Router Base	139	79
695	1-1/2 HP Router/Shaper	418	235
696	Heavy Duty Shaper Table	238	135
351	3"x21" Belt Sander w/o bag	302	165
352	3"x21" Belt Sander with bag	312	169
352VS	3x21v/s Belt Sander w/bag	321	174
360	3"x24" Belt Sander w/ bag	397	214
361	3"x24" Belt Sander w/o bag	377	204
362	4"x24" Belt Sander w/ bag	412	224
97751	1/2" v/spd Hammer Drill w/cse	274	158
9118	Porta Plane Kit 7 amp	400	229
505	1/2 sheet Pad Sander	249	134
7549	Top handle Jig Saw 4.8 amp	254	145
97549	7549 jigsaw w/ case & blades	275	148
330	Speed Block Sander 1/4 sheet	120	65
556	Biscuit joiner w/5556 fence	Sale	139
345	6" Saw Boss 9 amp	207	114
9345	345 comp. w/cse & carb blde	237	138
9647	TIGER CUB Recip. Saw	230	134
9637	Full var/spd Recip Saw 8 amp	276	148
7519	3-1/4 HP Router 2 Handle	469	255
7518	3-1/4 HP 5 speed Router	534	279
7539	3-1/4HP v/spd Plunge Router	534	279
7310	5.6 amp Laminate Trimmer	176	98
97310	Laminate Trimmer Kit comp	336	198
7335	5" Rndm Orbit Sndr w/ case	254	138
97355	7335 w/ case & dust pick-up	274	154
7336	6" Rndm Orb Sander w/ cse	259	139
97366	7336 w/ case & dust pick-up	284	158
73333	Dust Collection system		24.50
9853K	12V 3/8" Drill Kit w/ 2 batt	305	164
9855	12V 1/2" 2 spd,v/spd Drill Kit	310	178
8500	12V battery for above drills	Sale	45
332	Palm Grip Rndm Orb Sander	133	74
333	above sander with dust bag	148	79
334	333 Sander with PSA pad	148	79
550	Pocket Cutter with case	352	195
552	Production Pocket Cutter	1000	575
7700	10" "Lazerloc" Mitre Saw	740	409
310	Production Lam. Trimmer	270	152
347	7-1/4" "Framers" Circ Saw	230	129
347K	347 Saw w/ plastic case	250	134
743	347 Saw - left hand version	230	129
743K	743 Saw w/ plastic case	250	134
447	347 Saw with brake	259	139
843	447 Saw-left hand version	259	139
7800	Drywall Sander	589	335
7810	Wet/Dry Vac for above sander	452	259
9737	New Tiger Recipro Saw	307	165

New Porter Cable Pneumatic Nailers

BN125	Brad Nailer -18 ga. 5/8"- 1-1/4"	144	99
BN200	Brad Nailer -18 ga. 3/4"-2"	238	145
FN200	Finish Nailer -16 ga. 3/8"-2"	270	165
FN250	Finish Nailer -16 ga. 1"-2-1/2"	362	225
DA250	Angle Nailer -15 ga. 1-1/4"-1-1/2"	412	249

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Free book details western hardwoods

In the West, but especially the Pacific Northwest, hardwood trees take a distant second to softwoods commercially. After harvest, softwood timberlands are replanted with more softwoods, such as Douglas fir. This practice leaves in doubt the future of western hardwoods like madrone, tanoak, black oak, white oak, red alder, and laurel, now primarily converted to firewood and pulp chips.

In an attempt to shed light on the forestry practices necessary to grow hardwoods and to explain their uses, Oregon State University's College of Forestry has published *Hardwoods of the Pacific Northwest.* The 115-page book is available free by calling Oregon State University Forestry Publications at 503/737-4271.

Say hello to hoop pine, mate!

Are you impressed by working with void-free Baltic birch plywood from Scandinavia? Then you just might want to try Australian hoop-pine plywood.

Manufactured entirely from the wood of the hoop pine *(Araucaria cunninghamii)*, a large-diameter conifer, the newly imported product features appearance-grade knotless plies, tight grain, hardness, plus finish-sanding that's undeniably superfine. In 1/16" (1.5mm) and 1/8" (3mm) thicknesses, hoop-pine plywood is extremely flexible. Available in interior, exterior, and marine grades, the product comes in 3×6' sheets (1/16" and 1/8" thicknesses) and 4×8' sheets (1/4" or 6mm and 1/2" or 12mm thicknesses). A sheet of 1/4" exterior material costs about $55. Uses for this premium plywood (comparable to aircraft-quality birch) include furniture, boats, airplanes, and bending applications.

According to Riteco Supply, Inc., of Houston, the United States distributor, hoop-pine plywood has been made in Australia under the brand name Brimsply since the early 1900s. The wood comes from hoop-pine plantations in the temperate Queensland region of northern Australia. To locate a hoop-pine plywood dealer, call 713/896-6200. FAX 713/896-6100.

Sawing with sweat and steam

Come Labor Day weekend each year, Mt. Pleasant, Iowa, hosts behemoth steam machines of the past. Visitors to the Midwest Old Threshers Reunion watch the hissing steam engines run tractors, threshers, trains, a sawmill, a veneer slicer, a shingle mill, and other machinery.

Late summer can be hot and humid in Iowa, but the weather has never in 35 years discouraged Gerald Sears, 70, from hauling his steam-powered sawmill over from Adair, Illinois. Run by a 1918 Rumley steam tractor (called a traction engine) with a belt drive, the 1951 Corley sawmill (*below*) with its 52" blade can saw 4,500 board feet of lumber a day. "It takes five men and a lot of sweat and steam to saw those logs," says Gerald. "But it's great to fire up a big steam engine and put that power to work sawing wood."

The event holds other interest for woodworkers, too. Old-time craftsmen carve treenware, turn bowls, split white oak for baskets, and more. For information on the Midwest Old Threshers Reunion, call 319/385-8937.

Below: **The vintage sawmill setup at the Midwest Old Threshers Reunion features a steam traction engine rated at 20–60 hp. Sawing, it delivers the maximum.**

Below: **At an arbor speed of about 450 rpm, the sawmill's 52" blade easily saws through the red oak logs brought to the site for Gerald to custom-saw.**

Photographs: John M. Schultz
Illustration: Jim Stevenson

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Our new Sharpshooter™ staple gun takes only 19 pounds of force to drive a staple flush. (That's a third less than our leading competitor.) It also has an anti-jam staple core. And a patented double-bumper

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Picture shown with optional equipment.

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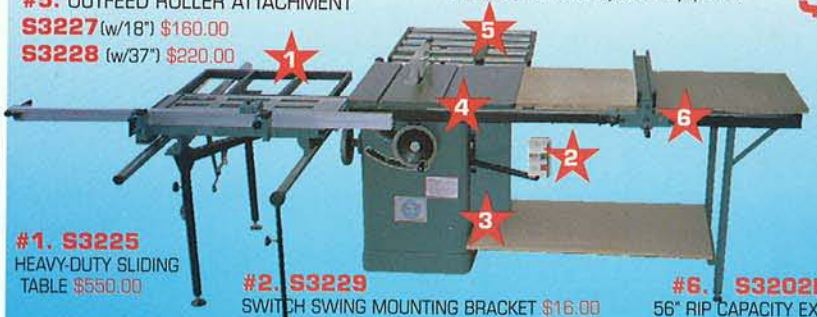
S3227 (w/18") $160.00
S3228 (w/37") $220.00



- •3 H.P.,
- •220V,
- •36" Rip Capacity
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- •110/220V

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NEW

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20" INDUSTRIAL BAND SAW

- •3 H.P., 220V
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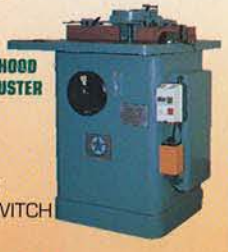

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12-1/2"X 6" PLANER

NEW

- •2 H.P., 110V

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24" DUAL DRUM SANDER

NEW

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- •FWD./REV.
- •5 H.P., 220V

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(1 OR 3 H.P. ALSO AVAILABLE)

- •220V, 2 INTAKES @ 4"

S3820

FREE 4" X 10' HOSE! A $12.95 VALUE

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6" x 47" HEAVY-DUTY JOINTER

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8" x 65" SUPER HEAVY DUTY JOINTER

4"JOINTER ALSO AVAILABLE

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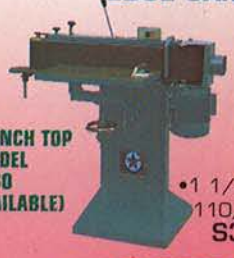
(OPTIONAL HAND CRANK ADJUSTMENT KIT ON INFEED AND OUTFEED TABLE ALSO AVAILABLE)

6" x 30" FLOOR STAND EDGE SANDER

(BENCH TOP MODEL ALSO AVAILABLE)



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S3406

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Better Homes and Gardens®

WOOD® PATTERNS™

Full-sized for your woodworking convenience

SEPTEMBER 1996 ISSUE 90

Dear Reader: As a service to you, we've included full-sized patterns on this insert for irregular-shaped and intricate project parts. You can machine all other project parts using the Bill of Materials and the drawings accompanying the project you're building.

- Doll cradle
- Shaker nightstand
- Wristwatch
- Tall clock

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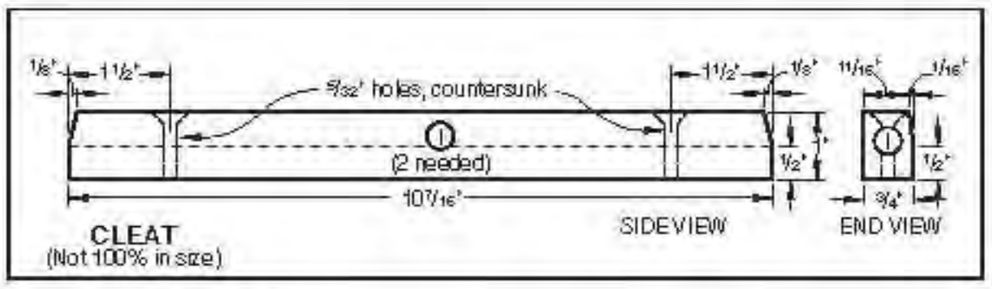
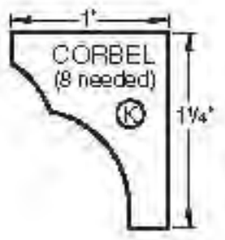
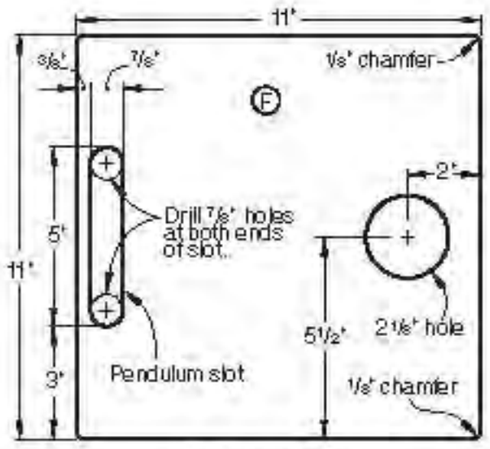
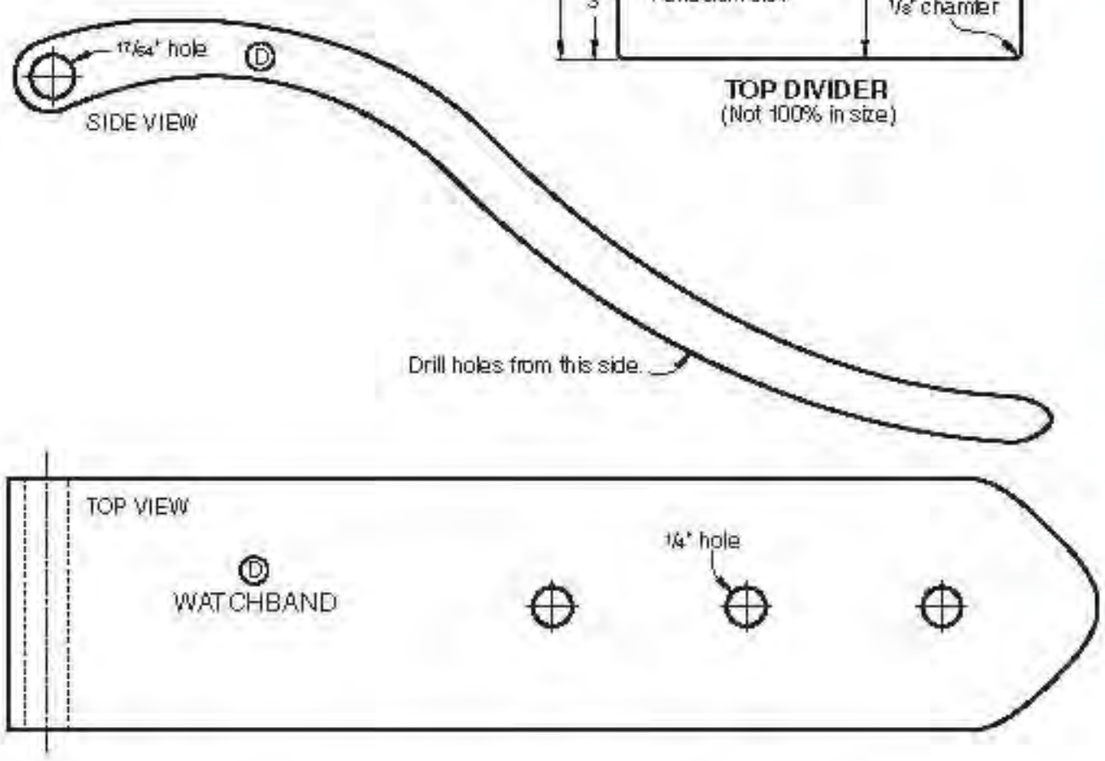


TALL CLOCK
Pages 60

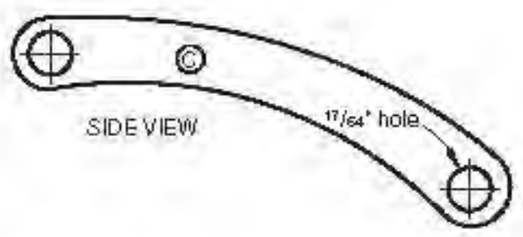


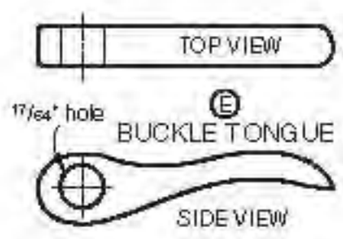


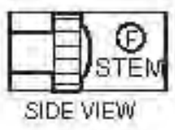
TOP DIVIDER
(Not 100% in size)

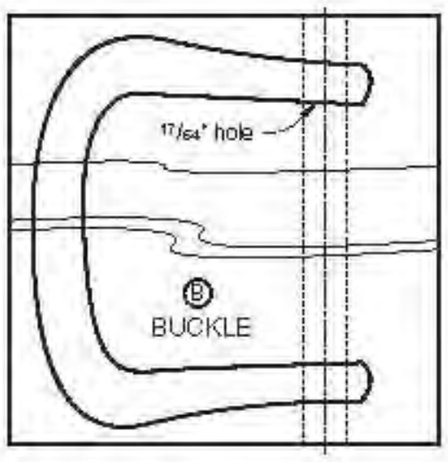


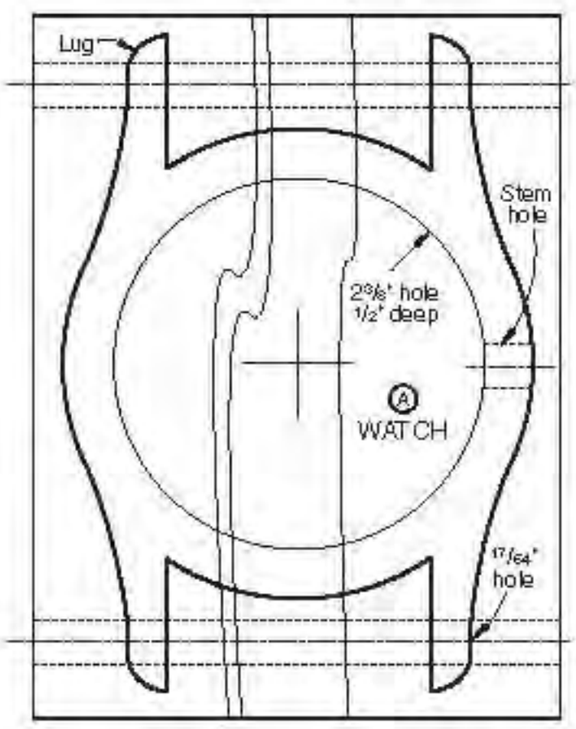
WRISTWATCH
Pages 56





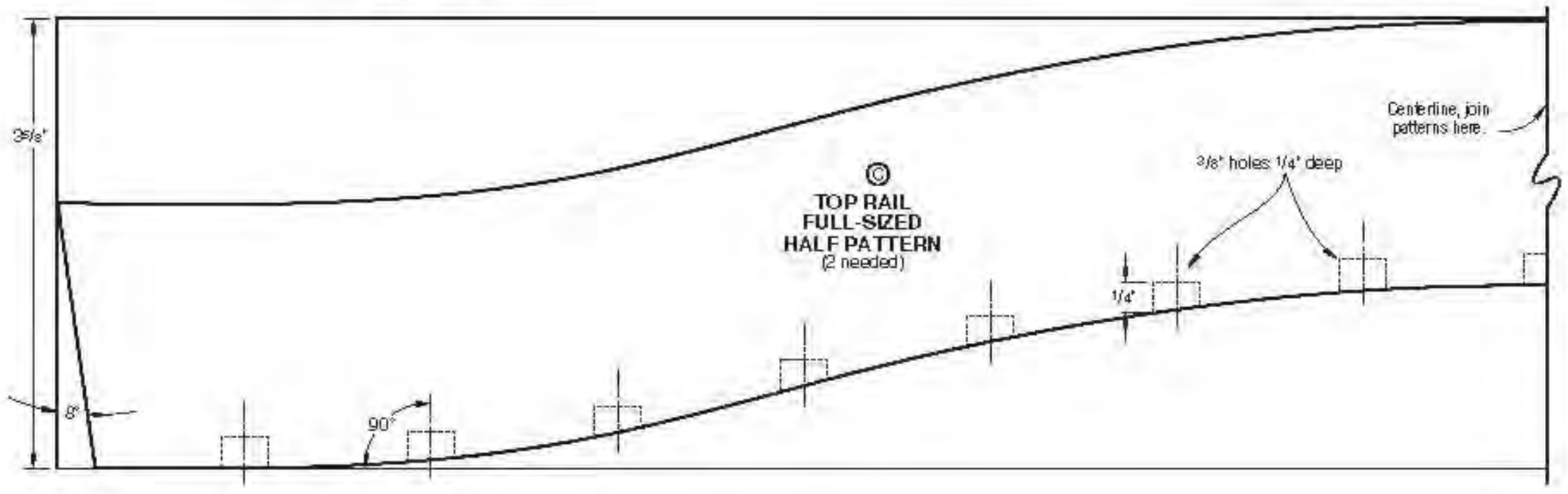


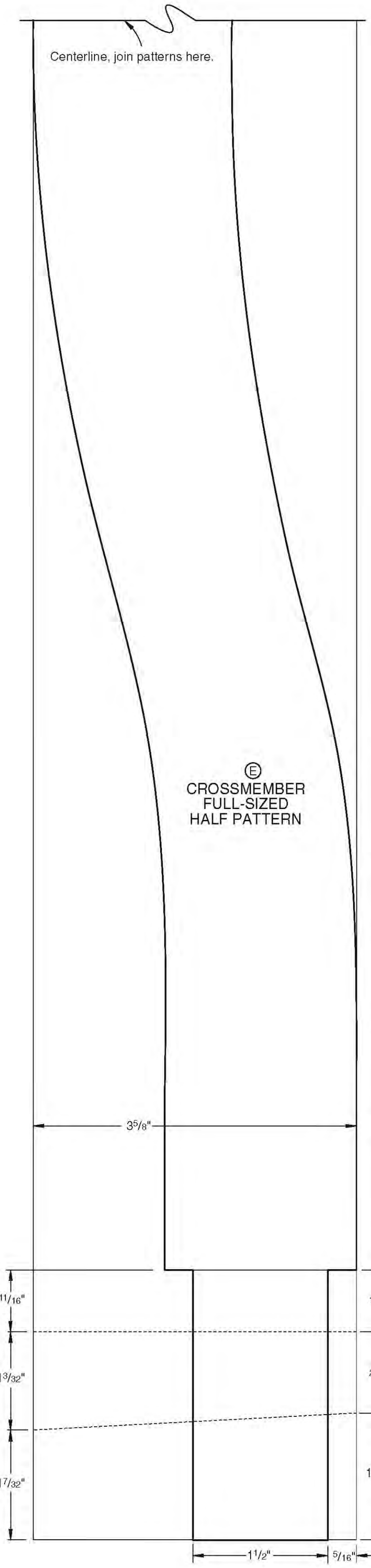




FULL- SIZED PATTERNS

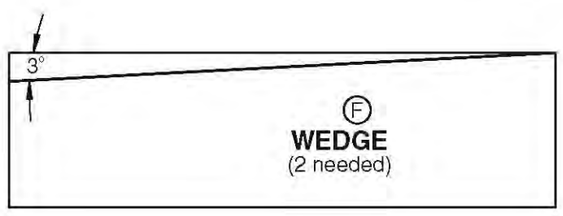
DOLL CRADLE
Pages 40



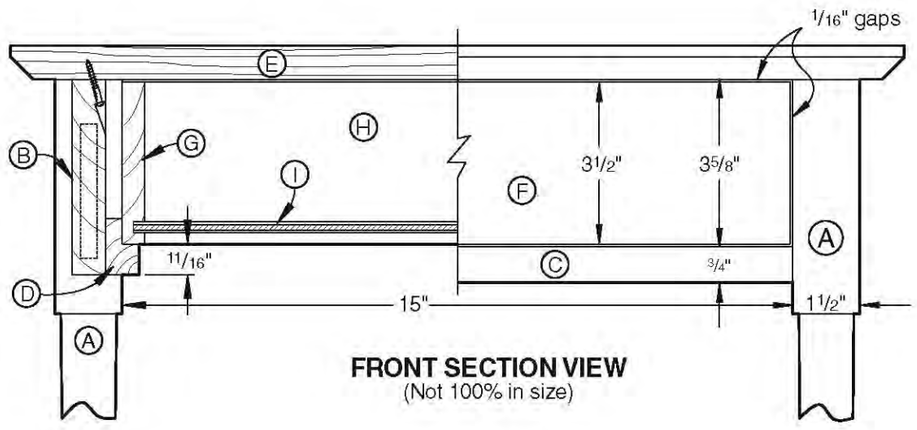


Ⓔ
CROSSMEMBER
FULL-SIZED
HALF PATTERN

DOLL CRADLE
Page 40

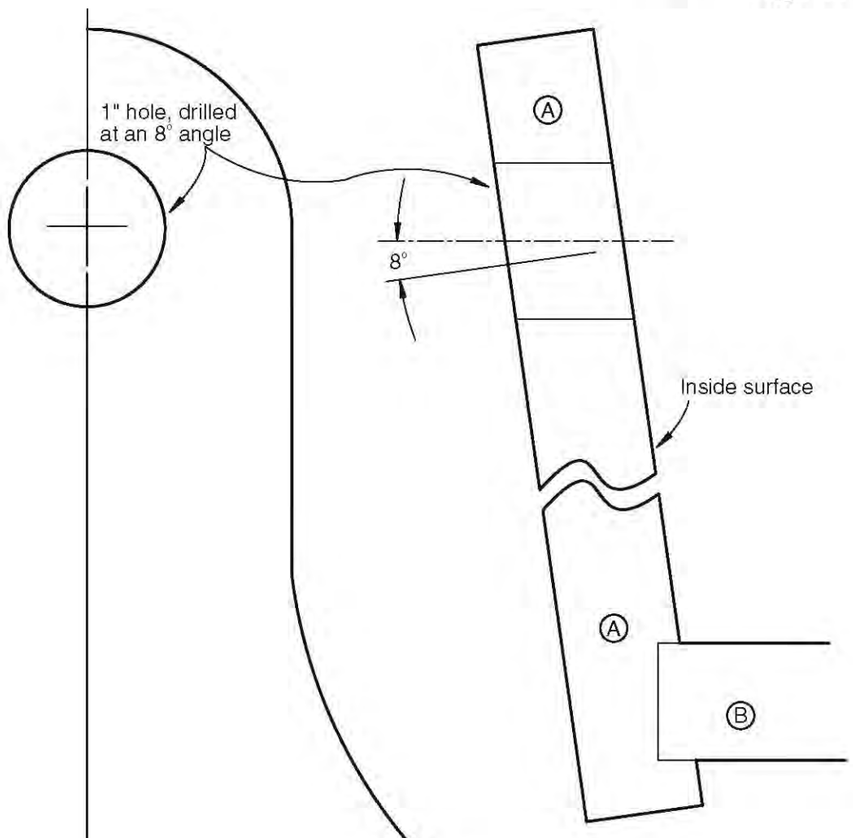


Ⓕ
WEDGE
(2 needed)

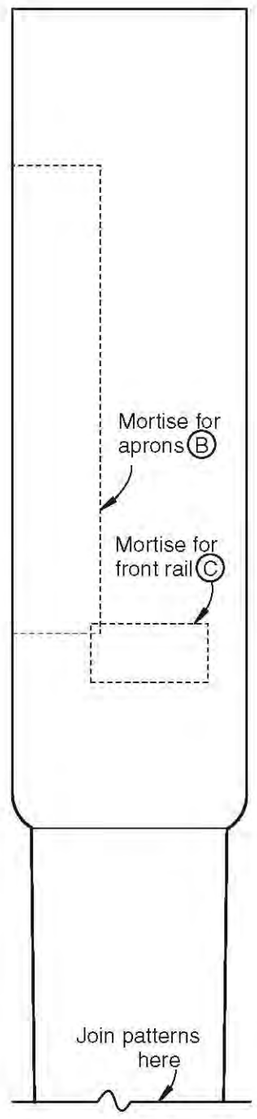


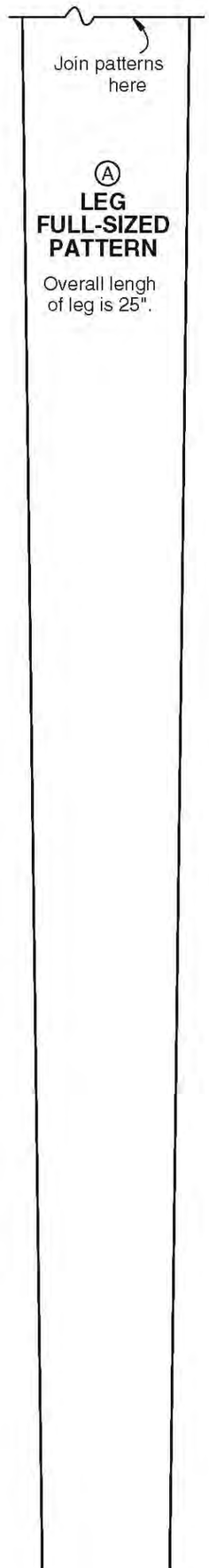
FRONT SECTION VIEW
(Not 100% in size)

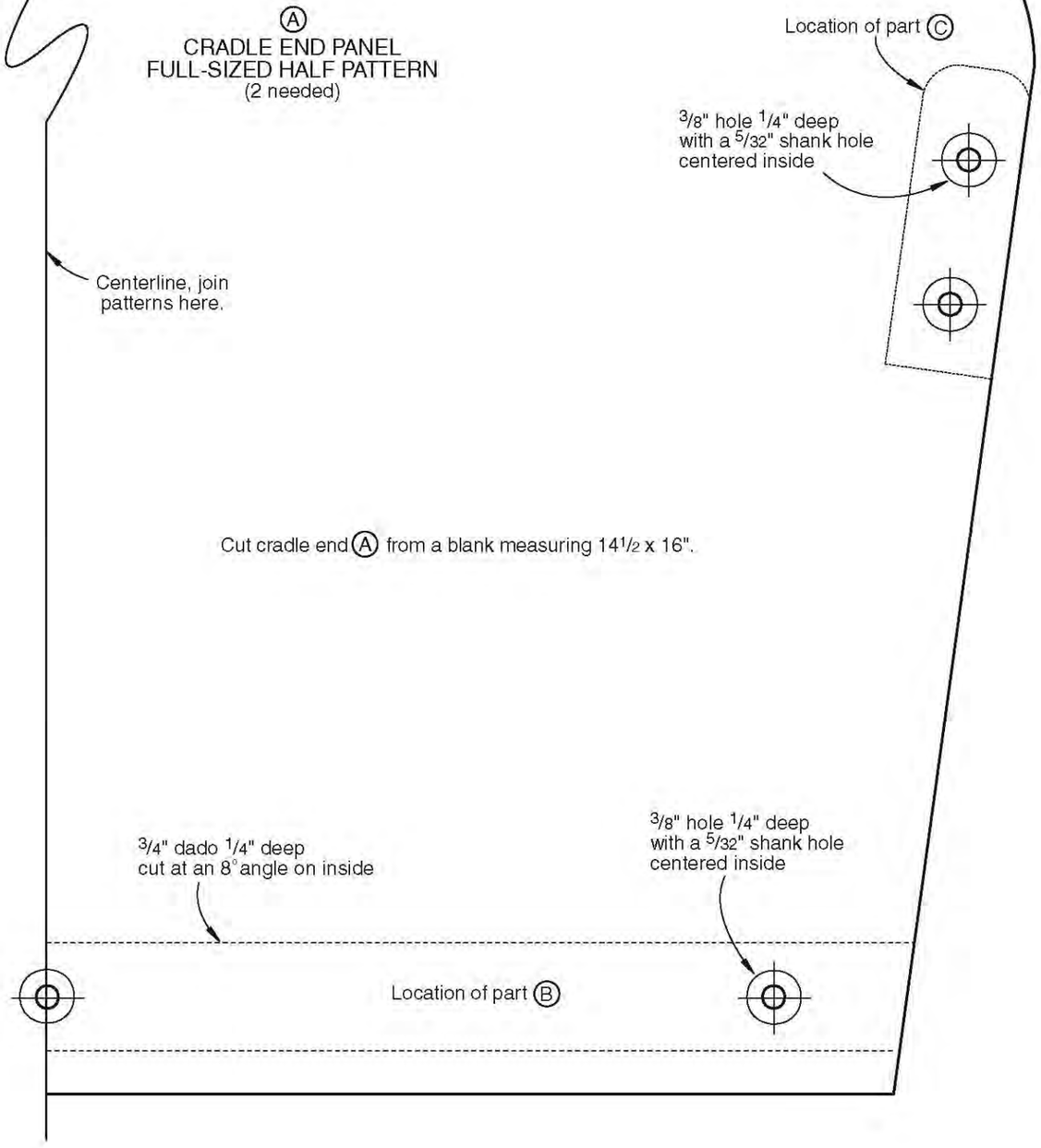
SHAKER NIGHTSTAND
Page 44



Ⓐ
CRADLE END PANEL
FULL-SIZED HALF PATTERN
(2 needed)





Ⓐ
LEG
FULL-SIZED
PATTERN
Overall lengh of leg is 25".

FULL-SIZED PATTERNS